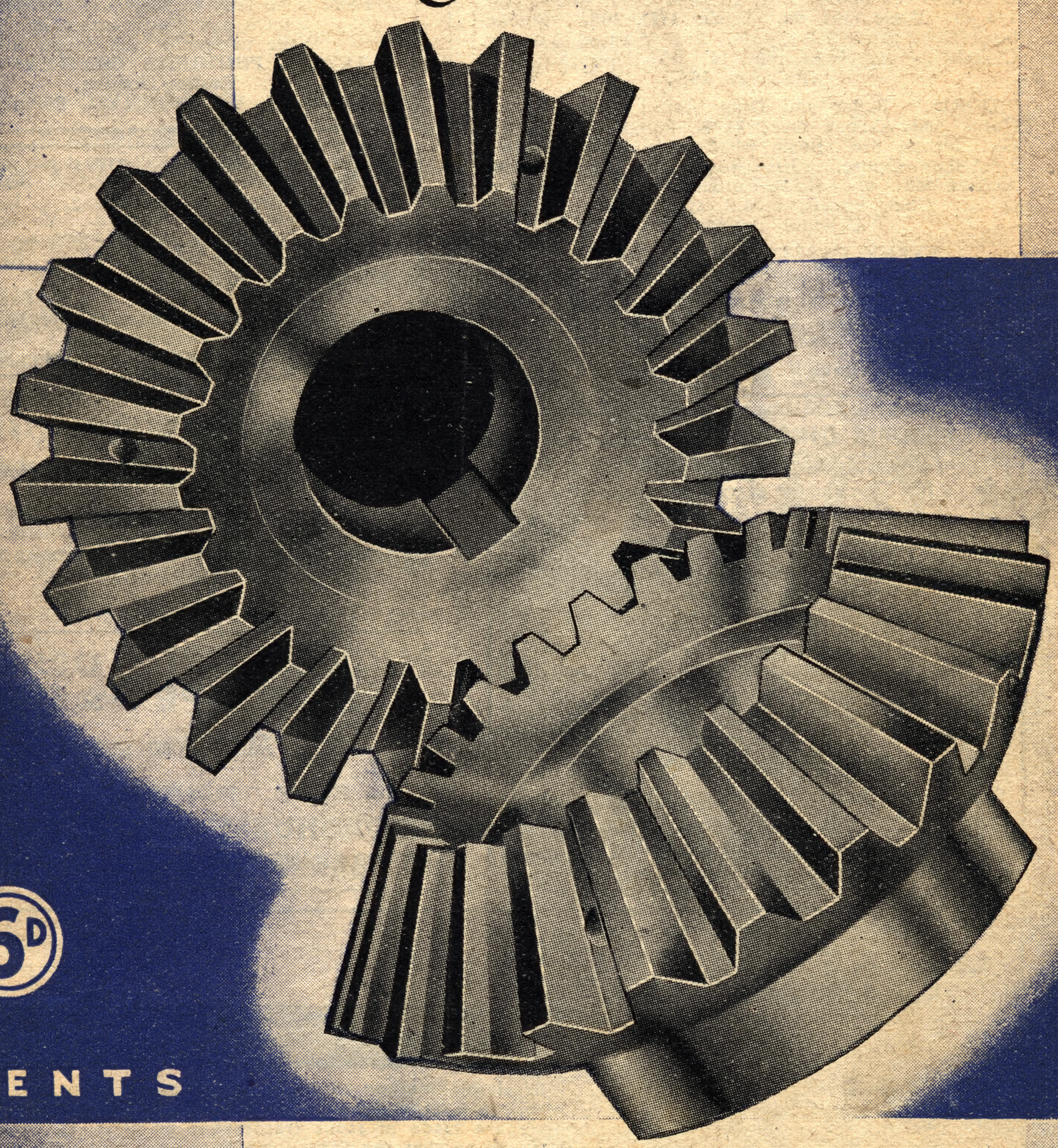
FRIDAY, AUGUST 27, 1948

MECHANICS

For Engineers & Craftsmen



6D

CONTENTS

Mechanics visits "M.E." Exhibition • Fabricated pipe bends • Making a mike • Electro-plating at home • Readers' questions analysed • Fastest club news service • 'L.B.S.C.' on 'Roedean'

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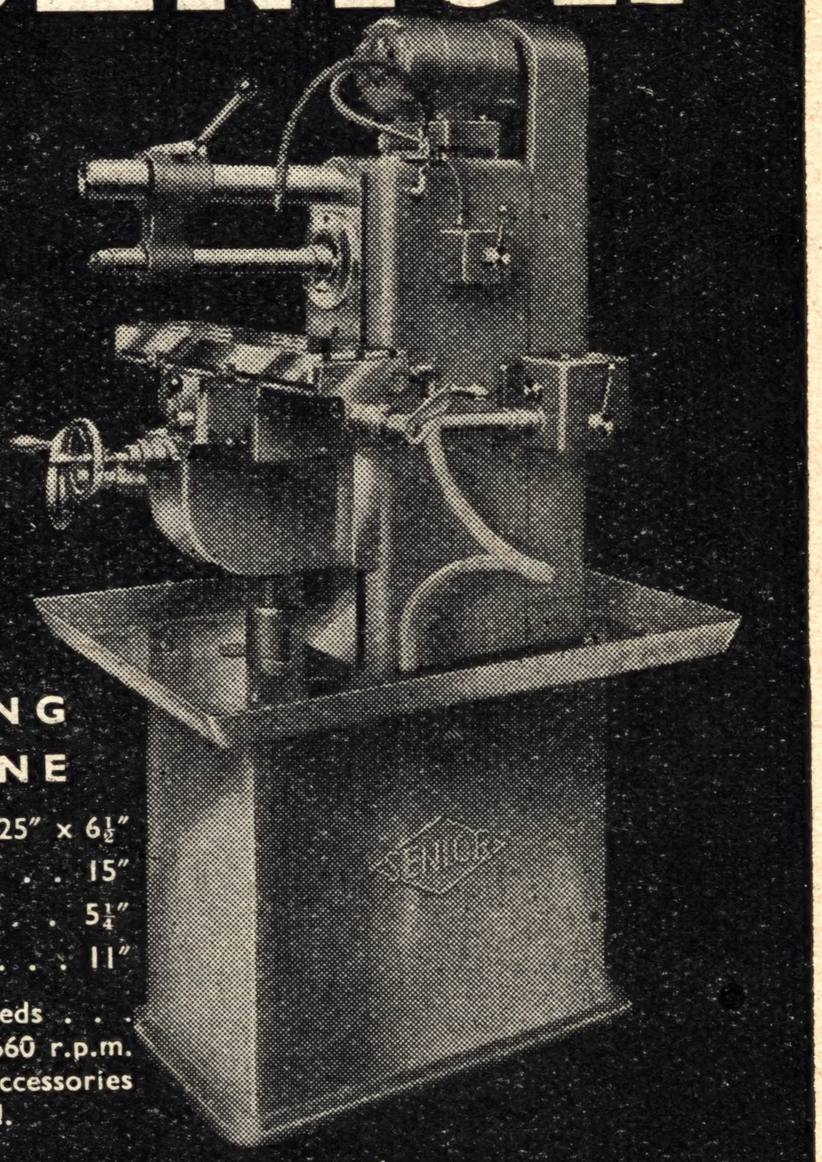
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AUGUST 26th — SEPTEMBER 11th

*

Machine Tool and Engineering Exhibition, Olympia

*

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FRIDAY, AUGUST 27, 1948

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News in Brief

Listen: Wednesday 10 a.m. Light, "Science and Everyday Life"; Wednesday 7 p.m. Light, "The Organisation of Science and Scientists"; Thursday 6.45 p.m. West, "First Solo"; Friday 7.15 p.m. Third, "The Health of Society—No. 5. Medicine in Industry"; Saturday 10.40 p.m. Third, "The Control of Atomic Energy—The Present Position."

£6,000,000 Brabazon I, Britain's 125-ton airliner, has now left its closely-guarded eight-acre hangar at the Bristol Aeroplane Company's Filton works to undergo ground tests prior to first flight, planned for November. 27 tanks hold 13,500 gallons of petrol.

Vehicle sales by Ministry of Supply now total over £20 million. Ten more sales of about 14,000 vehicles are yet to be held.

Old railway Pullman coaches in process of conversion into self-contained "flats" have been installed on the recreation ground of a firm filling a valuable contract for exporting cigarette - making machinery to America. The coaches will accommodate fifty married and single workers and are fitted with electric light, cookers and baths; the weekly rental is 25s.

Course organised by Institution of Gas Engineers is to commence January, 1949, and will finish in September, 1950, when examinations in ancillary subjects will be set. The course includes a period of practical training with a gas undertaking.

Hydro-electric scheme involving harnessing the Owen Falls on the White Nile, is undergoing consideration by Government of Uganda. Estimated power available, at a cost of one-tenth of a penny per unit, is 2,500,000 kilowatts. The scheme would probably be in full output by 1953, total expenditure, £4,160,000.

Machine Tool Exhibition

"GIVE us the tools and we'll finish the job" was the sickening saga of the war years when this country, desperately needing machine tools, was gearing its production to high level to defend and attack the enemy.

All this is over, but the people who use machine tools still have the desire to see what is new in the industry. The war-time expansion of the machine tool industry was phenomenal and the hundreds of exhibits that will be seen by visitors to the Machine Tool and Engineering Exhibition at Olympia from August 26 until September 11 will bring together for the first time for 14 years what will assuredly be a revelation in developments.

This International Exhibition exceeds in size and quality of exhibits anything that has preceded it. This is the view of the President of the Machine Tool Trades Association, Mr. J. Holland Goddard, in an introductory message to the Catalogue issued. He says: "The Machine Tool with its ancillary equipment constitutes the basis of modern civilisation. Never in the history of the world has there been so great a necessity in time of peace for the rehabilitation processes which cannot even begin without the Machine Tool. To visitors from Great Britain and lands beyond the sea we present, not without some pride, this great assembly of tools to finish the job of establishing peace, happiness and prosperity. The Machine Tool Trade demonstrates here its willingness and its ability to take its proper part in restoring the world to order, security and well-being."

We are sure that *Mechanics* readers will wish to visit this Exhibition, and if they are not immediately interested in the purchase for their factories and own experimental workshops of some of the equipment shown in the Exhibition, a visit will repay the time occupied because of the opportunities to examine the precision with which the machine tools are made, and to secure up-to-date information about the technical advances that have been made in this vital machine tool industry.

The Machine Tool Trades Association was formed primarily with the object of holding such an Exhibition when it was first founded, but through the years its value has increased and, because of its services to the industry, it acts in a way to advise with technical information and opportunities for business that should make it a valuable adjunct to the engineering industry of this country.

Whether long delays in delivery will be a hampering influence in the results which exhibitors secure from the Exhibition there is no doubt that this show will put a peace-time complexion on the war-time phrase of "Give us the tools and we'll finish the job."

Technical Developments

False ceilings consisting of transparent plastic sections are for concealing electrical and others fittings. The sections transmit 71 per cent. of light, are easily removable, and facilitate even distribution of illumination.

Plastic compound, developed during the war to protect ships and military equipment from the weather, is now helping to preserve plant and equipment at a big hydro-electric project in Australia. The preparation is sprayed on equipment to be preserved and forms a water-and-airproof envelope which can be stripped off quickly when required. It is used extensively to protect deck cargoes and marine equipment.

Camera produced in U.S.A. by Kodak has an exposure computor built into the back to facilitate easy reference.

Retractable rocket racks are fitted to wings of the U.S. Air Force's Republic F-84 Thunderjet. When the eight 140 lbs. rockets, mounted in pairs, are fired the racks fold up into the wings thus affording greater speed by streamlining.

Adjustable handlebars have been invented by an American cyclist. The handlebars are in two separate parts, locked in desired position by meshed cogs at the head, and released for adjusting by a finger-operated mechanism.

Moisture-proof, a new saltcellar has a ball valve which closes a small funnel against moisture. In use, salt escapes when ball is shaken out of position.

An Australian invention which enables anyone to replace heel tips on boots and shoes has been perfected. It consists of a steel plate in which a slot has been cut three-quarters of the way down the centre, and a leather or rubber heel tip. A tongue is fitted on the underside of the heel tip. The plate is securely screwed on to the heel, and the tip is then fitted to the heel by pushing the tongue into the slot. When the end of the tongue is turned on the front of the heel the tip becomes a fixture. Heels can also be fitted on the same principle. The inventor claims that people will now be able to re-heel their own shoes at a cost of about 6d.

Diesel locomotives for use on railways in Australia and the Far Eastern countries are to be manufactured at Granville, New South Wales, by agreement between the Clyde Engineering Company of Sydney and General Motors Corporation. The latter company states that its electromotive division pioneered the development of the Diesels in the U.S.A. and the value of its experience will be offered to the other manufacturing company. The arrangement will permit a low price and speedy delivery of the major components.

New method of manufacturing steel taper pins used in the engineering trade, has been developed by a company at Melbourne. The method is to cold swage the pins to form by the use of special machines. The pins are claimed to possess superior mechanical properties and are of higher accuracy and better finish than those ordinarily produced by the turning process. The process can also be adapted to split taper pins, the split in the pin being almost indiscernable so that a "V" notch must be cut across the end to indicate the position of the split.

Non-chemical preparation perfected for the absorption and destruction of all odours and taints given off by food stored in refrigerators has been marketed. Any combination of foodstuffs may be stored together by use of the preparation. Even garlic or gorgonzola cheese cause no deleterious effects to susceptible commodities like butter or milk. Units for refrigerators and pantries are supplied in airtight transparent wrappings, and retain efficiency for approximately six months.

Power saw chains, usually imported into Australia, are now to be manufactured locally. Australian timbers call for a specially-designed saw, particularly to cope with the density of local hardwoods. Tests have been carried out on saws that are used normally for softwoods, and on the same type of chain after use on Australian hardwoods, in order to arrive at specifications for the product.

11,000,000 watt transformer has been built in U.S.A. for a steam power plant. The transformer supplies enough electric power for a city of 200,000 people, and has nine propeller-shaped fans to cool its oil-filled radiators.

Five times stronger than ordinary glass, interlocking glass sections can be assembled on both sides of aluminium frames to form partitions or walls. Electric lighting units and apparatus can be installed inside the walls. The 20 ins. square panels are supplied clear, diffused or patterned to taste.

MAKING A MIKE—2

By W. COOPER

Machining the Thimble and Screw

THE thimble and screw, items "D" and "E" (see August 20) of the internal micrometer are shown in detail at Fig. 5. Both are of mild steel, unhardened, the former of ⅞ in. the latter of ½ in. material.

Externally, the thimble is tapered, knurled, radiused, graduated, and figure-punched; internally, it is bored and recessed. The 5/32 in. radius which joins the 11/16 in. diameter to the face is not a standard one blending smoothly with both the diameter and the face. It blends smoothly with the diameter, and then runs out to join the face and form a circle of ½ in. diameter. This is because the face accommodates four countersunk 1/16 in. Whitworth screws, equidistantly spaced on a ⅜ in. diameter pitch circle, which secure the screw. The hole for the handle is drilled in the centre of the knurled part of the thimble at a position 90 degrees removed from the zero graduation.

Externally, the screw has a thread of Whitworth form, 5/16 in x 40 t.p.i., to provide the micrometer movement, and a ¼ in. spigot to align it and a ½ in. diameter flange with 1/16 in. tapped holes to secure it to the thimble. Internally, it is drilled right through 3/32 in., and the end opposite the flange recessed 15/64 in. diameter ⅛ in. deep.

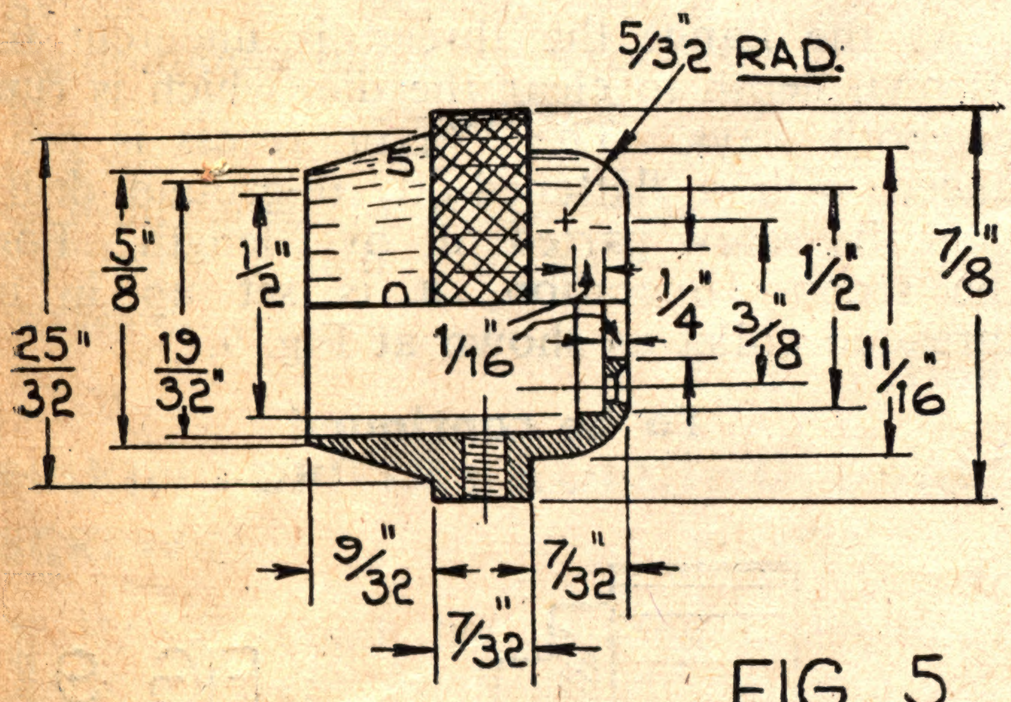
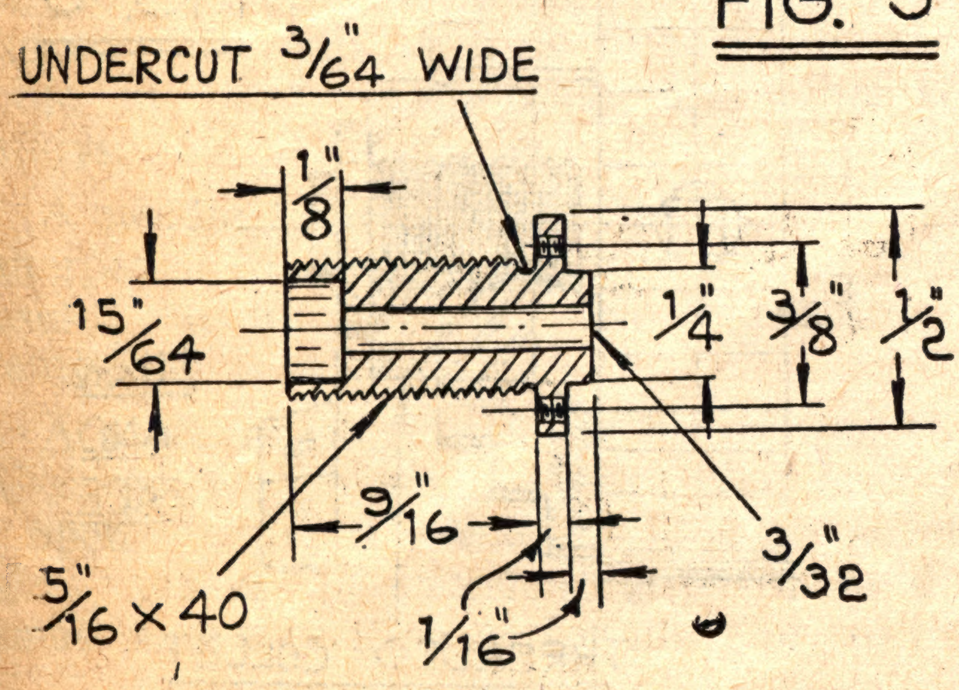


FIG. 5



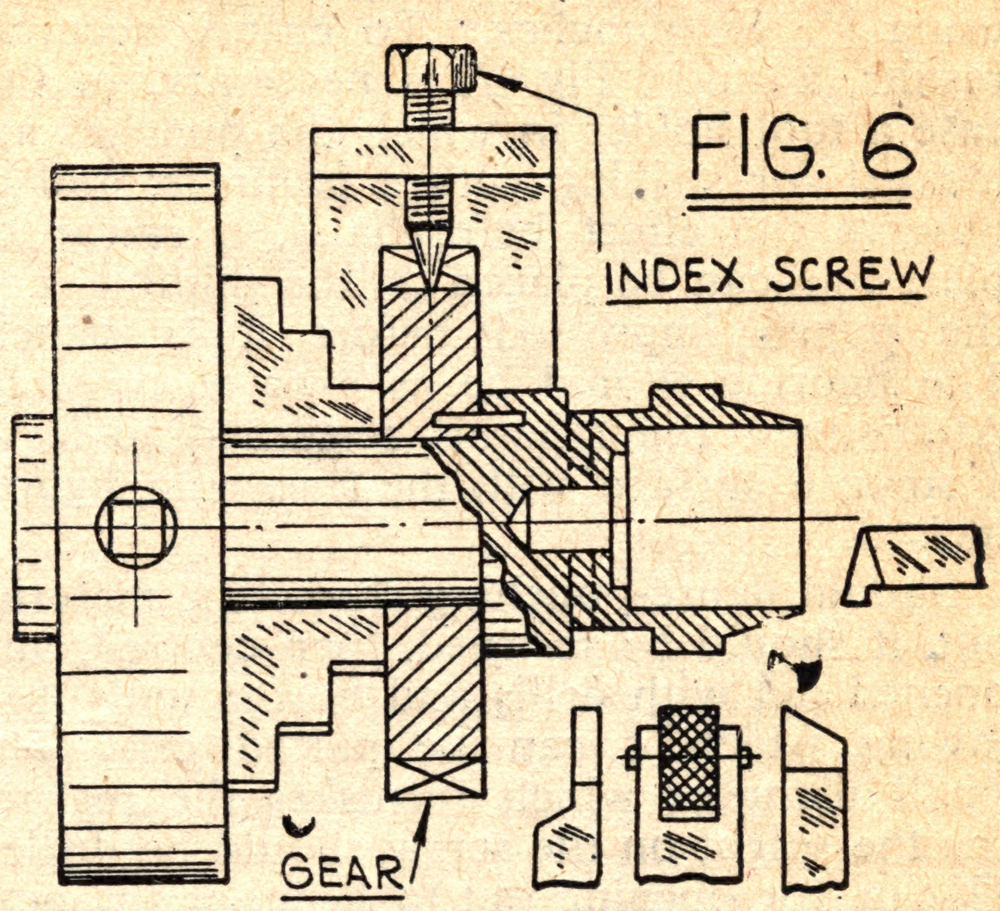


FIG. 6

The thread is flat-topped to provide a flank and to avoid a crest bearing in the nut—a construction which improves the accuracy and the setting of the micrometer.

Setting-up the Thimble

The thimble provides a variety of machining exercises in the performance of which sequence is as important as care and skill; it illustrates the principle—a principle often evident in large and heavy work—that not only the precision but also the order of the operations can profoundly affect the results.

In this instance, graduating and figuring, which affect results in so far as thereon depend the accuracy and neatness of the micrometer, come early in the order. On an indexing lathe, graduating is easily performed. On a non-indexing lathe, one of the change-wheels must be used. The ⅞ in. material should be turned down to enter the bore of the wheel, and the two pinned and set up in the independent chuck as shown at Fig. 6. The wheel should have 25, 50, 75, or 100 teeth, so that 25 divisions can be obtained by means of an index screw fitted to a piece of plate attached to the lathe bed.

The material is trued and faced, tapered at the front and undercut at the rear of the knurled position, using turning and parting tools, after which it is knurled. Burrs raised at the sides by this process are faced off, then the taper portion graduated, employing the change-gear and index screw, with a vee-tool mounted sideways in the slide-rest. Every fifth line is longer than the others and numbered, the numbering being 0, 5, 10, 15, 20. Should the pressure of

knurling throw the material out of centre, it must be re-trued before graduating—which should be to a depth to provide clear but not crude marks.

Graduating is followed by figure-punching, using 1/16 in. punches. To ensure accurate results, a guide, Fig. 7, is necessary, in this case a tool holder in which the punches are located for striking with a hammer; and to observe the effect beforehand, a smear of plasticine can be placed on the thimble, and the punch impressed before it is struck. The figuring should be as even as possible. Afterwards, the taper is re-turned to leave a smooth surface with the lines and figures incised.

Should figure-punching throw the material out, it should be re-trued, then centred, and opened out with drills and boring tools, following which it can be parted off. The small diameter which furnishes the register for the spigot on the screw should be drilled 15/64 in. for opening out to 1/4 in. at the next setting.

Second-operation Mandrel

This setting is obtained employing a stub mandrel of steel or brass, machined in the chuck, so that the thimble will just push tightly on, Fig. 8. At this setting it is faced and radiused, the register bored, and the circle for the holding screws scribed. These may be equidistantly spaced by employing a packing piece under each of the four jaws of the chuck in turn, to wedge against the lathe bed, while the scribing tool is used on the face across the circle. The relationship of the holes with the graduations is not important, but it can easily be such that one hole is in line with zero by twisting the thimble on the mandrel. The hole positions are marked with light centre-punch

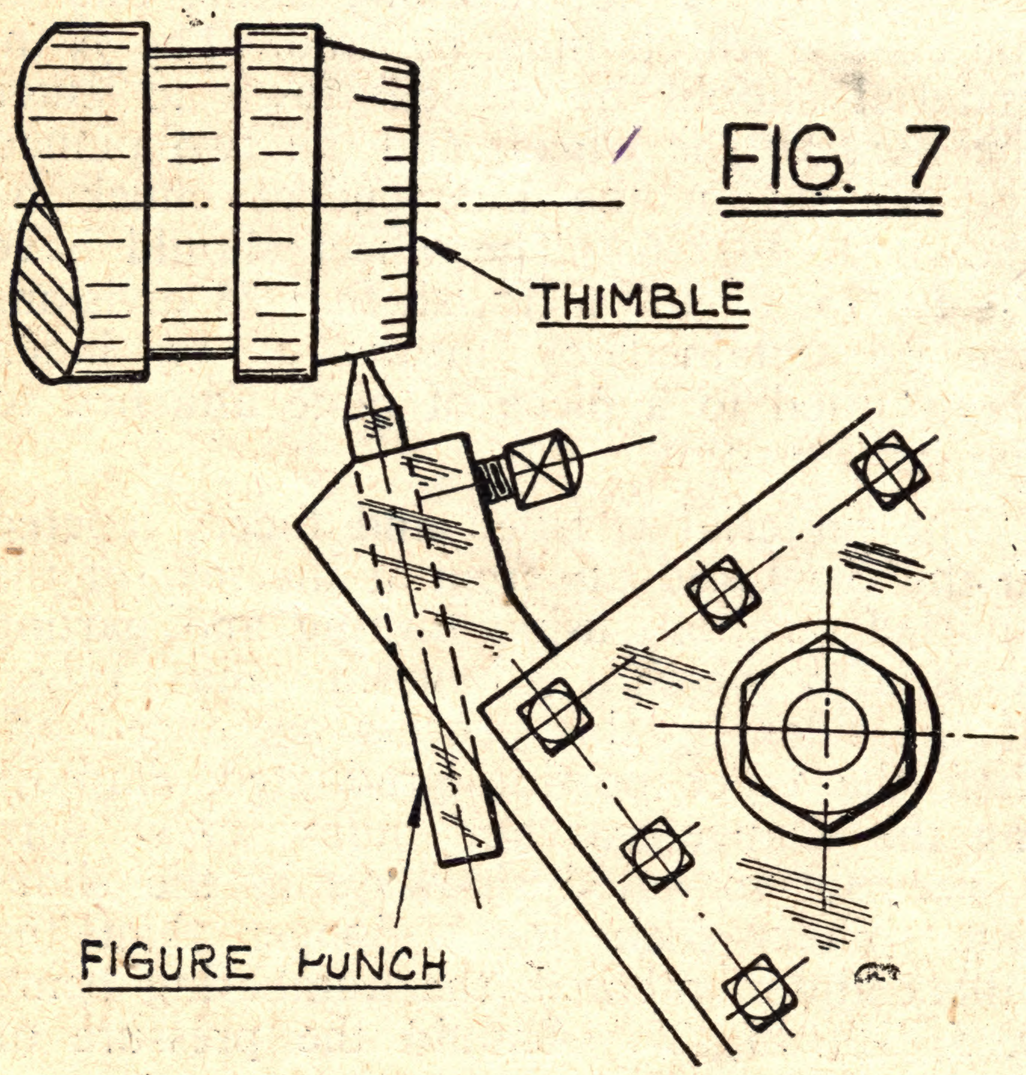


FIG. 7

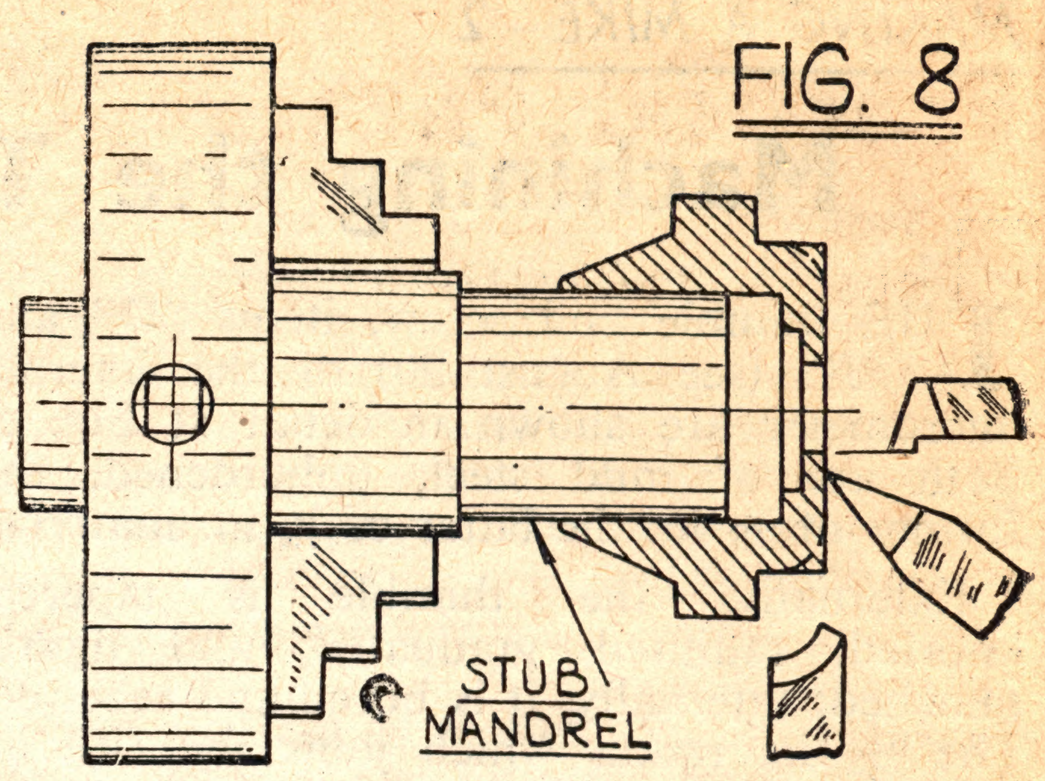


FIG. 8

dots, then drilled with a No. 56 drill, and only after the thimble has been used as a template for the screw, opened out with a No. 52 drill, and countersunk for the screws.

The hole for the handle is drilled and tapped No. 40 and 1/8 in. Whitworth, respectively.

Machining the Screw

The screw is finished with a die after being turned 0.005 in. undersize on the top diameter and screw-cut almost to full depth, this method providing a thread of more accurate pitch and form than the use of the die alone. It is advantageous, moreover, in that it obviates the use of a tailstock die-holder, for the die will "follow" the thread, whereas in a tailstock holder, owing to a slightly misaligned setting, though it cuts a true, it sometimes cuts a "thin" thread.

At the flange the thread is undercut to its own depth to clear the die, which is run on both ways. The 15/64 in. recess is produced with a flattened-off, re-ground drill, then the screw parted off over-length. For the second operation, it is set up in a threaded collet as shown at Fig. 9.

To be continued

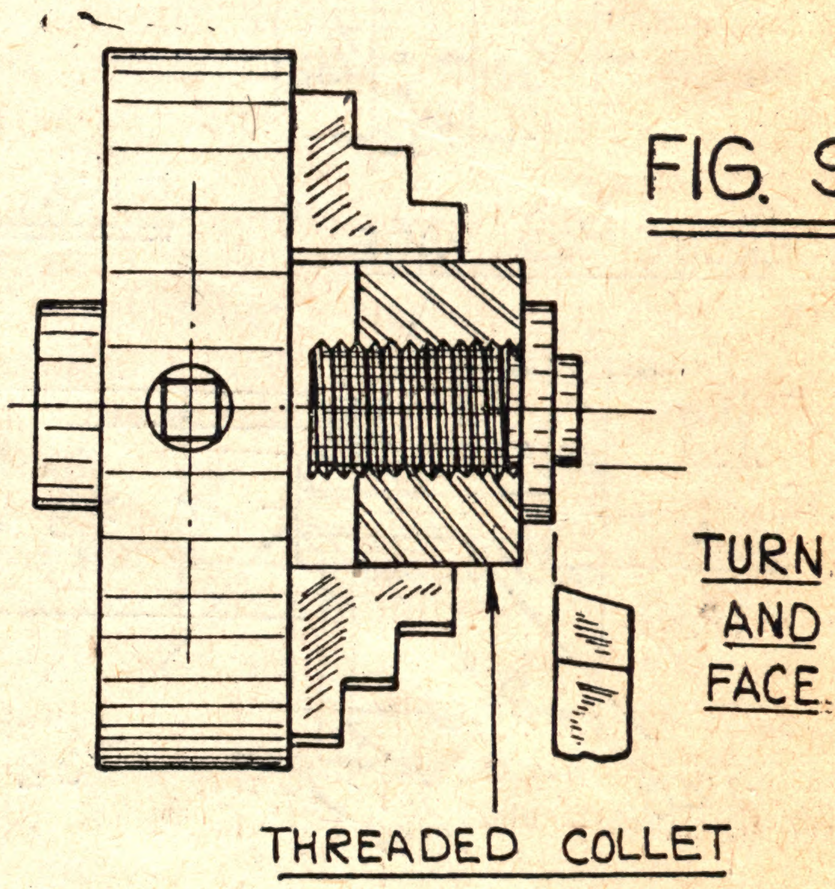


FIG. 9

Practical Paragraphs

Have you a hint that would help others? We pay for published items

CANES IN THE WORKSHOP

CANES, as used in the garden for training peas and other plants, deserve a place in the home workshop. They are relatively cheap and easy to obtain. These "canes"—for the term includes many reeds and grasses—are wands of four to six feet length, gently tapering, and with the surface interrupted at intervals by small nodes. Down the axis runs a pith-filled cavity, of circular section and tapering diameter, its continuity being briefly interrupted by wood at each node.

When using a hand drill, it is often necessary to limit the hole to some pre-determined depth. Select a piece of cane in which the cavity will form a snug fit over the drill to be employed. Saw off, squarely but a shade over-long, a length sufficient to bring the drill to about the right depth when bearing against the drill-chuck and the work surface.

Trim up the cut ends as smoothly and accurately as required and slip over the drill, driving out the pith in the same operation. A ready-cut supply of these serviceable little depth gauges will be found useful.

Among many other similar applications of this common material are the following: distance-pieces between light parts joined by screw, bolt and nail; depth gauge when hand-tapping blind holes (protects the point of the taper tap); "bushes" for worn or oversize woodscrew holes; plugs for light wall-plugging (in plaster—the cane should be thinly coated with glue, and the screw greased).

C. J. L. Holt.

MAKING DRILLS : HOLDING SMALL SCREWS

I HAVE found that a long D bit made from silver steel if ground up as a one-lipped drill will drill a remarkably clean hole in hard wood, brass, and other soft alloys.

A needle broken off at the eye end and sharpened to form a flat drill will be found useful on small work. No hardening or tempering is needed.

A piece of strip steel or brass bent to a U-shape, with a small V slot filed near the "open" ends, the whole made in several sizes, makes an excellent grip for holding small screws in the vice for filing or slotting.

W. H. Grayling.

CLOCK MAKES CALENDAR

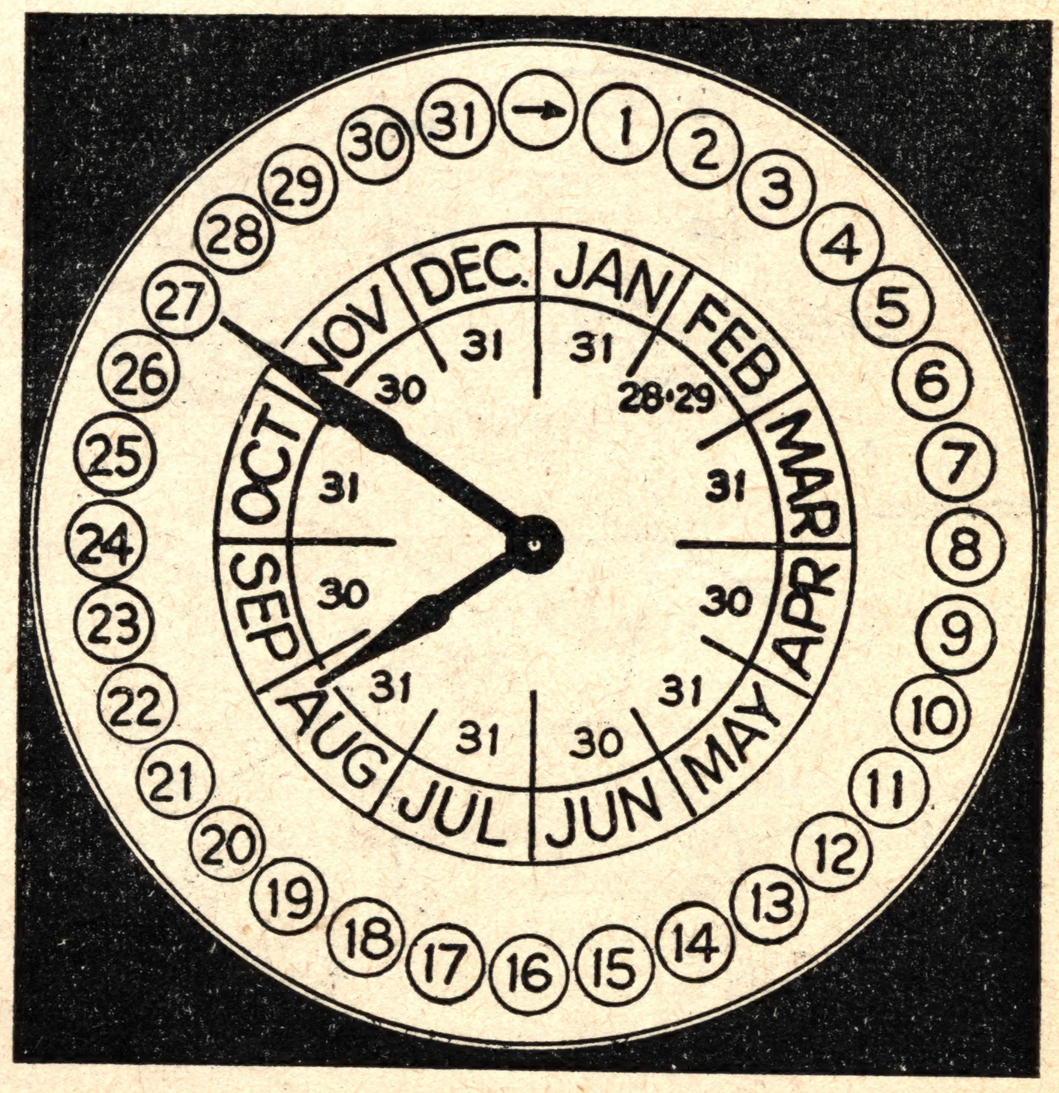
EVERYONE knows that the large hand of a clock revolves twelve times to one of the small hand, but it occurred to the writer that as there are twelve months in the year a clock mechanism might be used to give simultaneous readings of days and months.

To make such an automatic calendar, procure any clock in which the gear train between the hands works satisfactorily and if necessary remove the remaining gears; but take care to leave in the main spindle and hand adjusting knob. The hands should be carefully removed without damaging if required for the completed calendar.

Next copy the dial shown on the attached sketch and paste over the original clock dial. If the original hands are suitable they can be replaced, otherwise new hands can be made from stiff wire. To commence with, set the hands at "twelve o'clock" and turn the adjusting knob until the small hand and large hand point respectively to the correct month and day. Each day turn the large hand to the next figure until the number of days in the month as indicated is reached and on the following day advance to the "1." The small hand will always indicate the month without attention.

More ambitious readers may care to experiment with a ratchet and plunger on the adjusting knob, or an electric solenoid to work from a press switch, but the simple calendar described has served the writer satisfactorily for some time.

W. H. Sheppard.



WORKSHOP CALCULATIONS

By N. M. DAVE

Fabricated Pipe Bends

IN pipe layouts occasions frequently arise when ready-made bends are not available and it becomes necessary to fabricate these either from straight pipe or sheet metal. The latter material is almost invariably used for exhaust gas and air ducts, flues, chimneys, etc. The object of the following article is to present practical data in a form in which they can be readily applied for such fabrication.

In order that the process may be easily followed, the best method is to take a specific example. Suppose it is desired to make a 12 ins. bore gradual bend to change the direction by 90°. If thickness of plate = 3/16 in. outside diameter of the pipe, D = 12 3/8 ins. Make the pitch radius of the bend 1½ times D, i.e., 1½ x 12 3/8 ins. = 18½ ins. (approx.)

We can make a single-joint bend, or a two-joint, three-joint or four-joint bend as desired (see Fig. 1). Assume, a 3-joint bend is required in this case. Draw the section of a normal circular bend and divide the outermost quarter circle into 6 equal parts calling the points 0, 1, 2, 3, 4, 5, 6 (see Fig. 2). Draw radii 1Y, 3Y, 5Y from each of the odd points 1, 3, 5. A tangent OA is then drawn to the curve from O to cut 1Y at A, and another tangent from P to cut 1Y at Q. AB and QR are further tangents cutting radius 3Y at B and R; and so on, BC and RS; CD and ST.

Since the total change in direction is 90° and we have three symmetrical joints, the change in angular direction per joint is 30°.

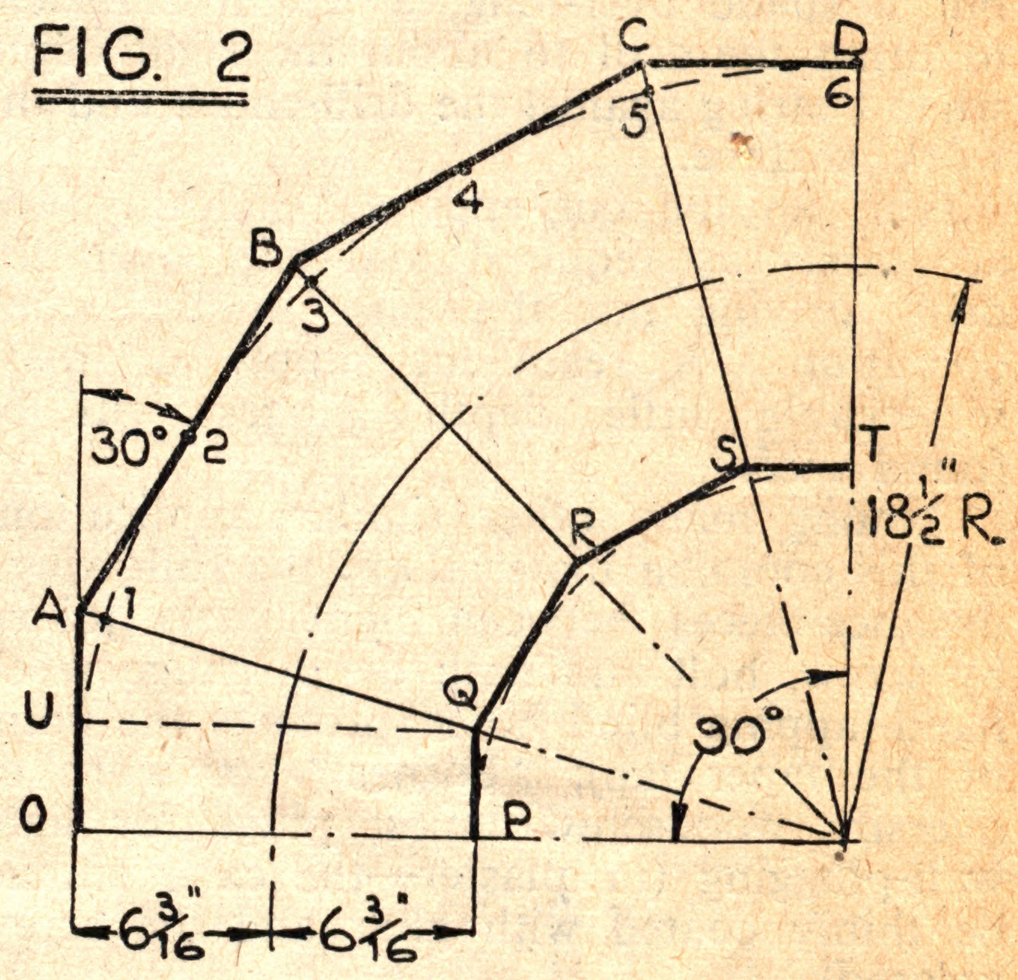
Calculations

Bearing this in mind, OA and PQ can be calculated from table I.

TABLE I.

Change in angular direction per joint	OA	PQ
90°	2D	D
45°	·83D	·414D
30°	·536D	·268D
22½°	·4D	·2D

FIG. 2



Example: For 12 3/8 ins. outside diameter and 30° change per joint, OA = 12.375 x .536 = 6.63 ins., i.e. 6 5/8 ins.; also, PQ = 3 5/16 ins.

AB and BC are each twice OA, and CD equal OA.

Note—The above values of OA and PQ hold only if the pitch radius of the bend is 1½D. For other conditions, OA and PQ should be measured by actual marking out.

After marking the distance OA along the pipe the next thing to do is to make the oblique cut AQ on the first bit of pipe. To mark off this cut on the convex surface of the pipe, a cylindrical template is prepared from a strip of thin sheet steel equal in length to the circumference of the outside diameter of the pipe, in this case, 38.9 ins. (see Fig. 3).

Divide this strip into 16 equal parts and raise ordinates at each point a, b, c, d, e, f, etc., as calculated from table II.

FIG. 1

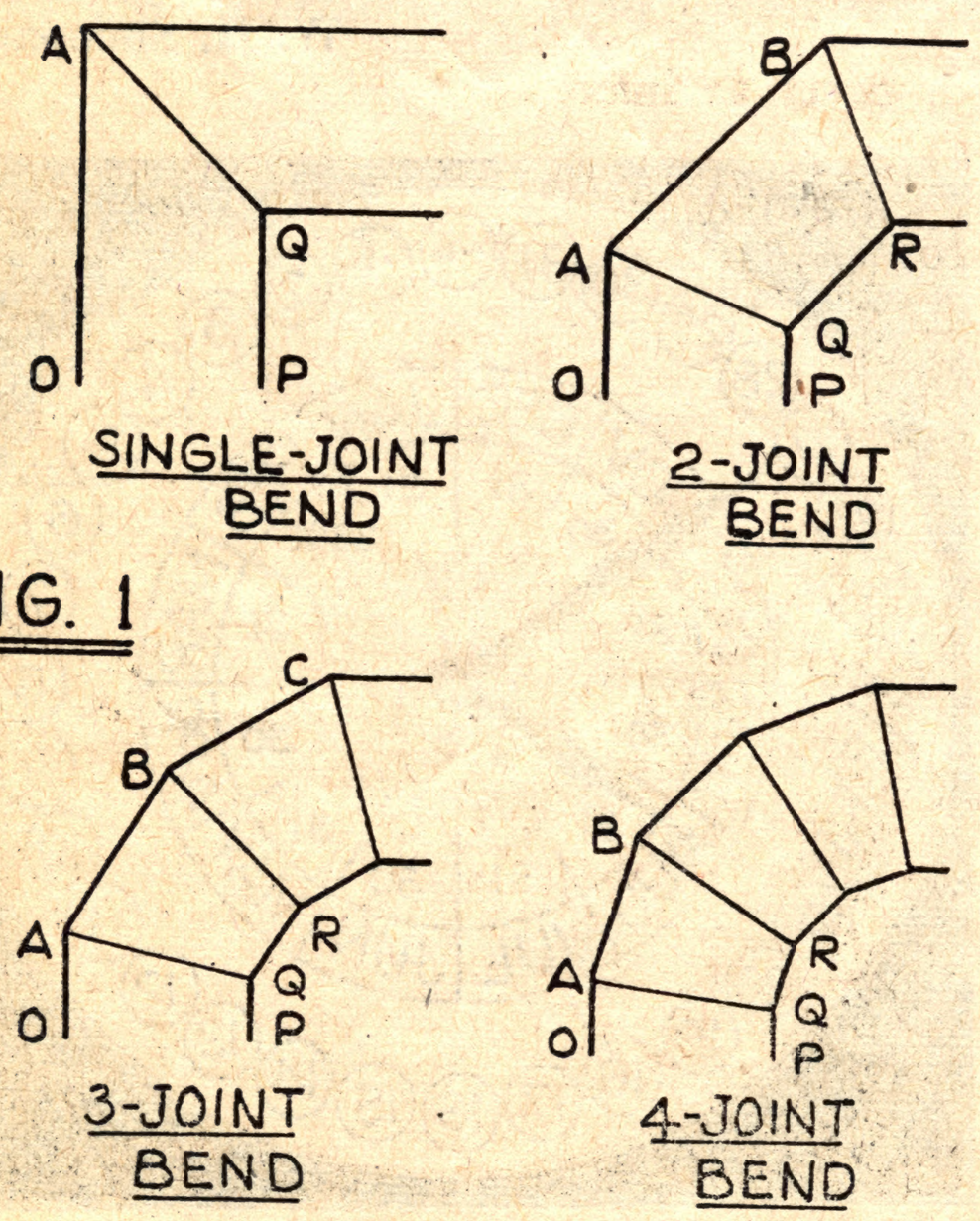


TABLE II.

Change in angular direction per joint	a	b	c	d	e	f	g	h	is
90°	0	·012	·047	·098	·159	·220	·272	·306	·318
45°	0	·005	·019	·04	·066	·092	·112	·126	·132
30°	0	·003	·013	·026	·043	·059	·073	·082	·085
22½°	0	·002	·009	·02	·032	·044	·054	·061	·063

FIG. 3



Multiply the figures in the table by the outside circumference of the pipe.

Example: For 38.9 ins. circumference and a 30°-joint, the ordinates are: a = 0; b = .116 = ⅛ in.; c = .508 = ½ in.; d = 1.01 = 1 in.; e = 1.67 = 1 11/16 ins.; f = 2.30 = 2 5/16 ins.; g = 2.84 = 2 27/32 ins.; h = 3.19 = 3 3/16 ins.; i = 3.30 = 3 5/16 ins.

Preparing to Cut

Join the points by a smooth curve, cut out the template and roll it into a cylindrical form over the pipe to be cut (see Fig. 4). The position of the template is adjusted so that the base of the highest ordinate *i* is against the point U (see Fig. 2). The cut AQ is then scribed out on the surface of the pipe against the curve of the template.

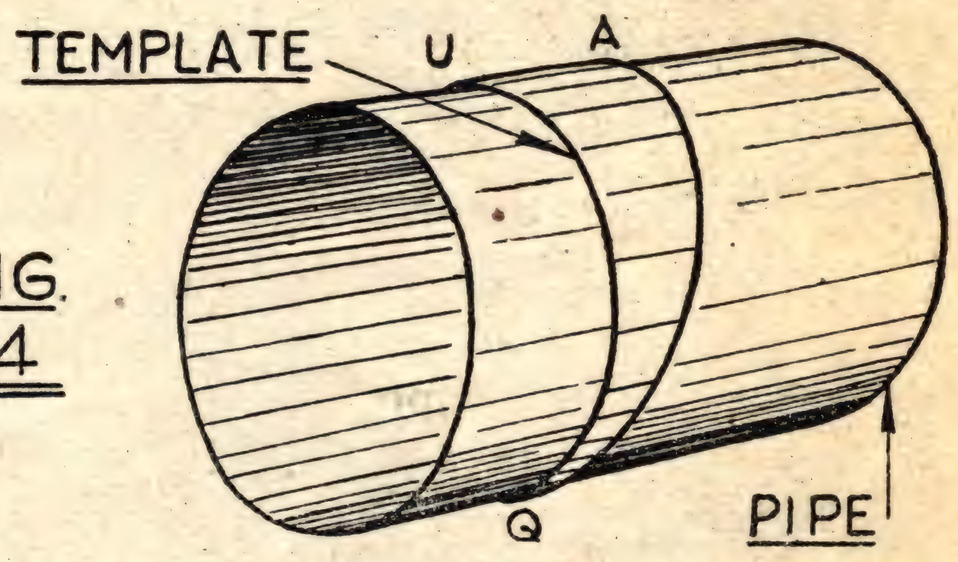
The second section ABRQ is marked off in an identical manner from the same template, except that the oblique cuts occur on both ends and converge from the side AB towards the centre. (AB has been determined earlier from table I). The third section is similar, and the last is again a half-section exactly as the first with the sense inverted.

The pipe sections so cut are then tacked up, total angle and overall dimensions of the bend carefully checked, any little adjustment done; finally the joints are welded in the usual manner.

The above example illustrates the construction for a total change in direction of 90°. If this is required to be 30°, there need be only one 30° joint and two sections; if 60°, two 30°-joints; if 67½°, three 22½°-joints. If the seams of fabricated bends are correctly tailored in the above manner, it will be found that much trial and error in the shop are eliminated and neat-looking bends turned out.

The factors given in tables I and II are usually sufficient for every-day work but if the change in angle per joint has any other odd value, say θ, OA and PQ can be calculated from the following relations:

FIG. 4



OA = 2D tan $(\frac{1}{2}\theta)$, and PQ = D tan $(\frac{1}{2}\theta)$. (Equations 1 and 2).

Thus, for 15° change per joint,

OA = 2D tan 7½° = .263D, and PQ = .132D.

Similarly, the ordinates a, b, c, d, of table II can be calculated thus:

$$\text{Ordinate } y = \frac{1}{2\pi}(1 - \text{Cos}\Delta) \tan(\tfrac{1}{2}\theta) \times \text{outer circumference of pipe,}$$

(Equation 3) where, θ, as before, is the change in angle per joint and Δ = angle measured on the circumference corresponding to the ordinate y. Since we divided the circumference into 16 equal parts, the ordinates a, b, c, d, occur at intervals of $\frac{360°}{16} = 22\frac{1}{2}°$, i.e., for ordinate a, $\Delta = 0$; for b, $\Delta = 22\frac{1}{2}°$; for c, $\Delta = 45°$ and so on.

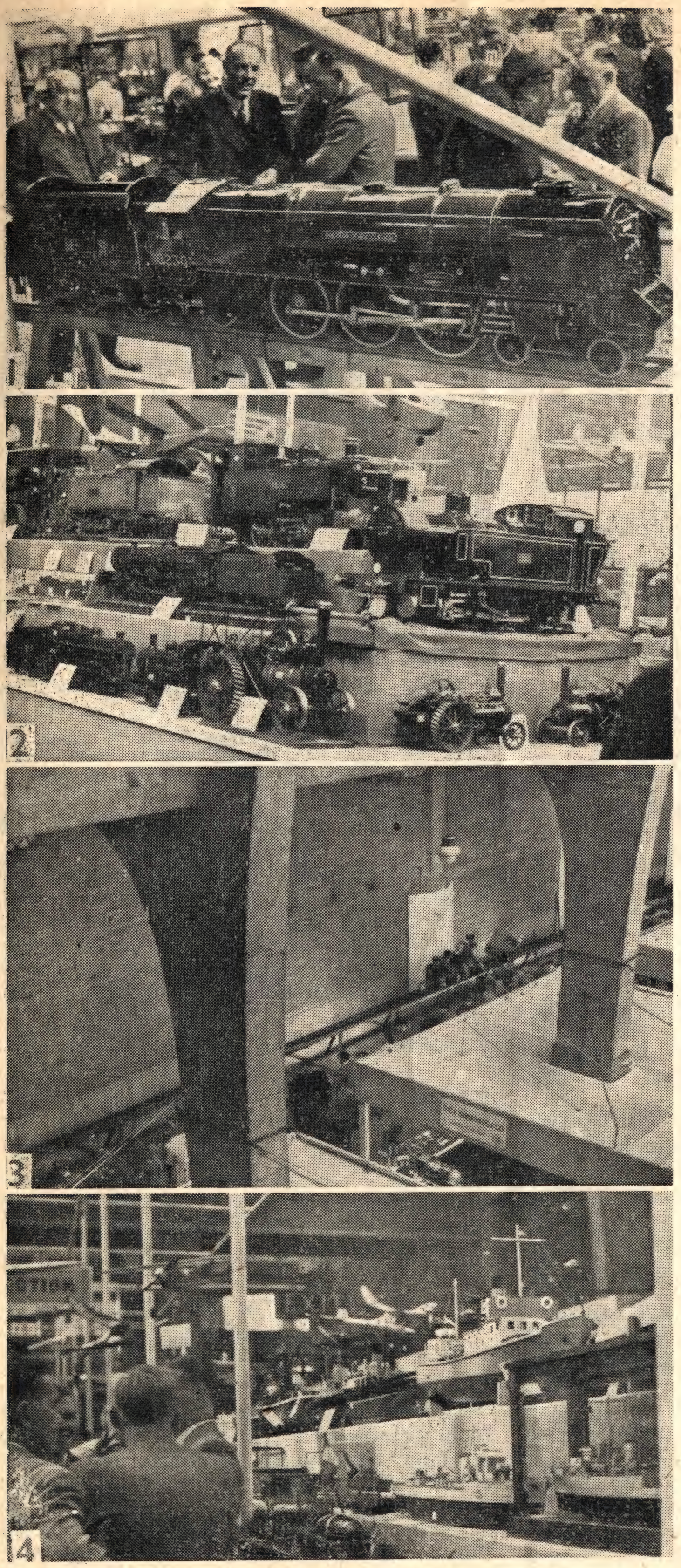
Example:

Ordinate c for 15°-joint = $\frac{1}{6.28}$ x (1 — Cos 45°) tan 7½° x outer circumference of pipe

= .047 x .132 x outer circumference of pipe

= .006 x outer circumference of pipe.

Anyone interested can derive equation 3 from principles of geometry with the help of data already given above, bearing in mind that the height of the ordinate varies directly as its projected distance from the zero ordinate position, and this projected distance in turn varies as 1 — CosΔ.



"Mechanics" vis
Engineer"

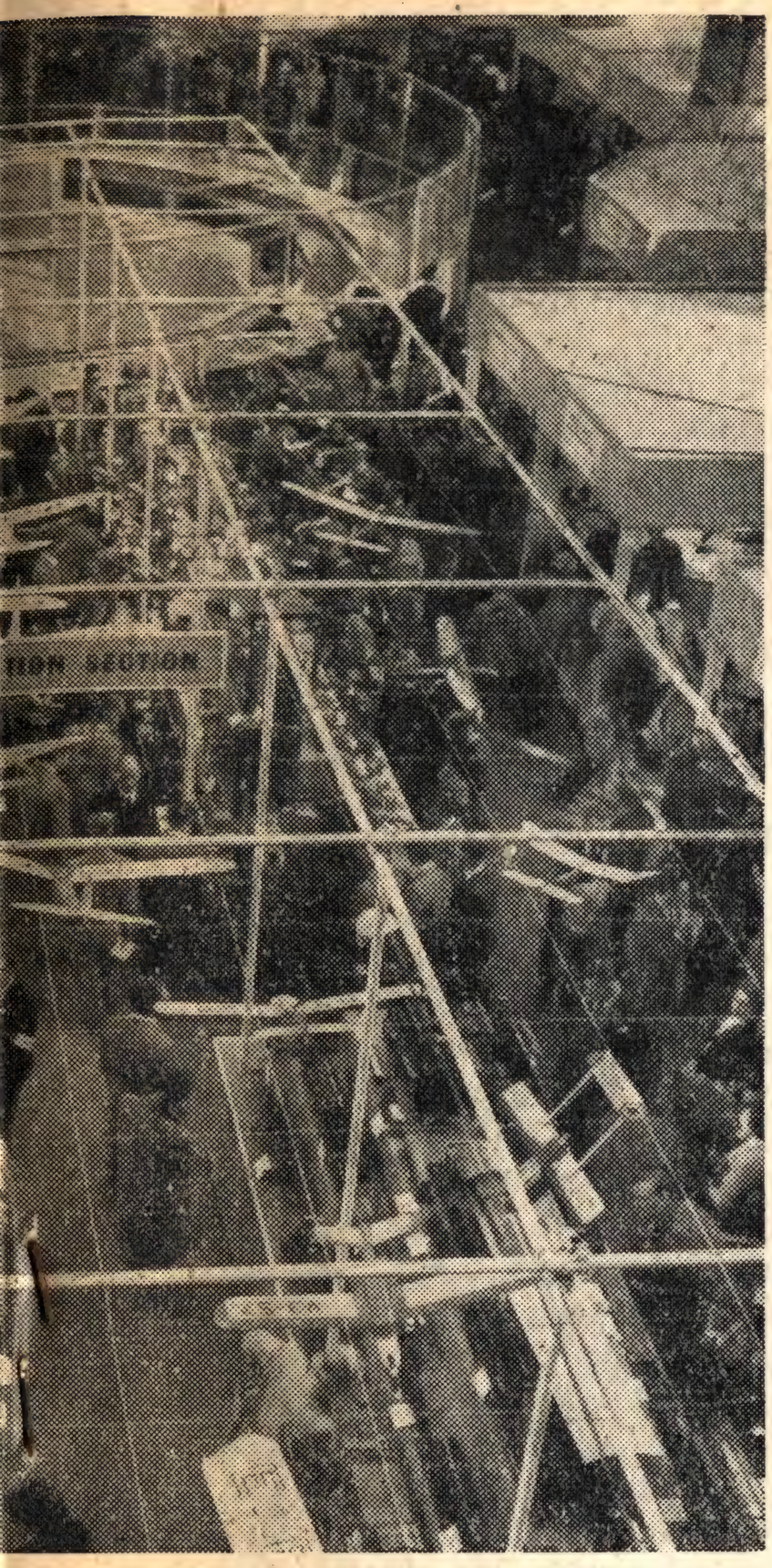
Royal Horticultural Hall, Lon

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All exclusive "Mechanics" photos, H.P



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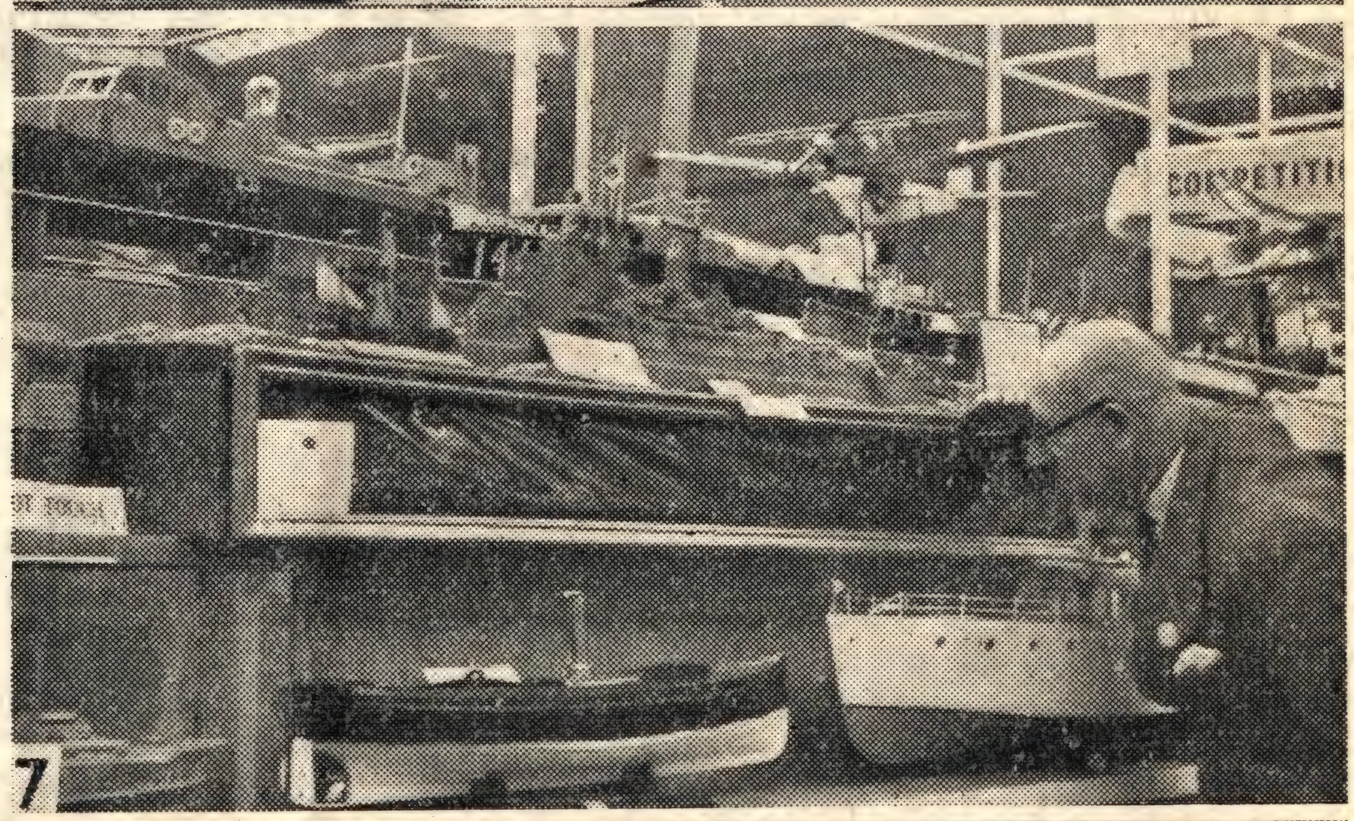
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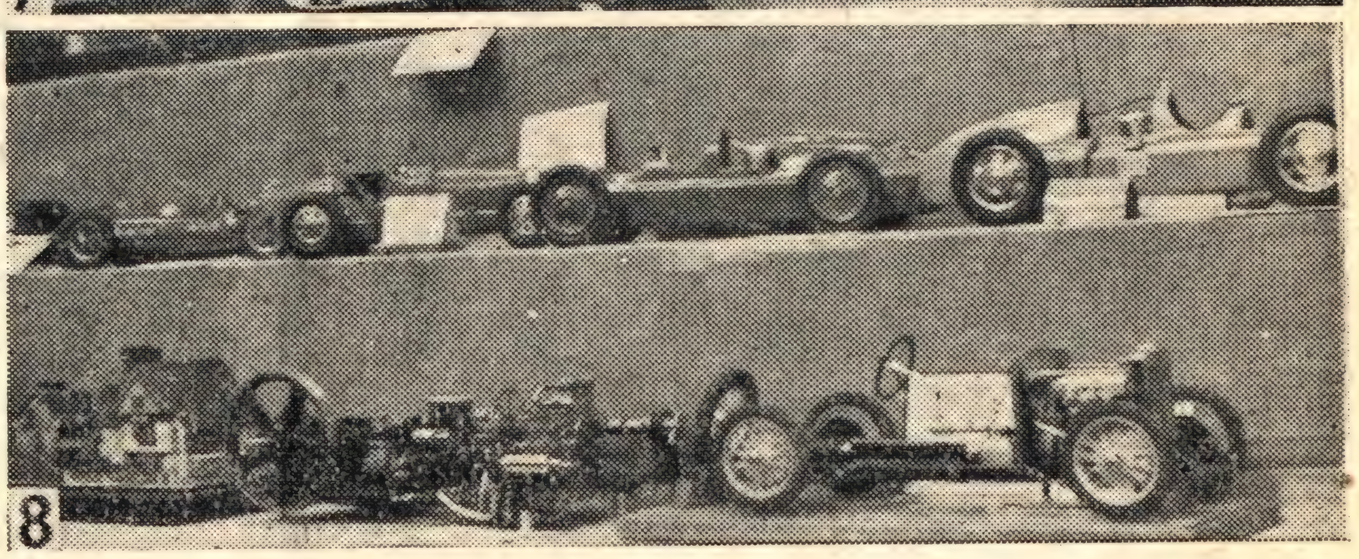
P.3. *MORE PHOTOS IN CLUB NEWS*

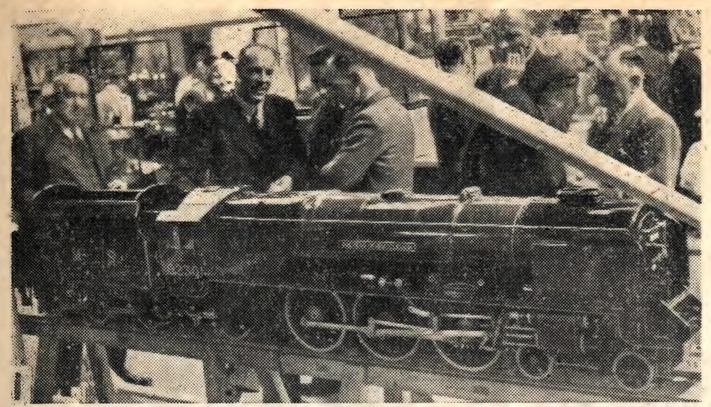


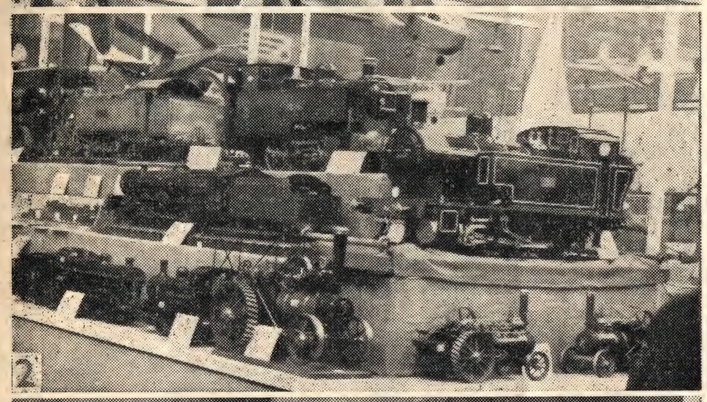
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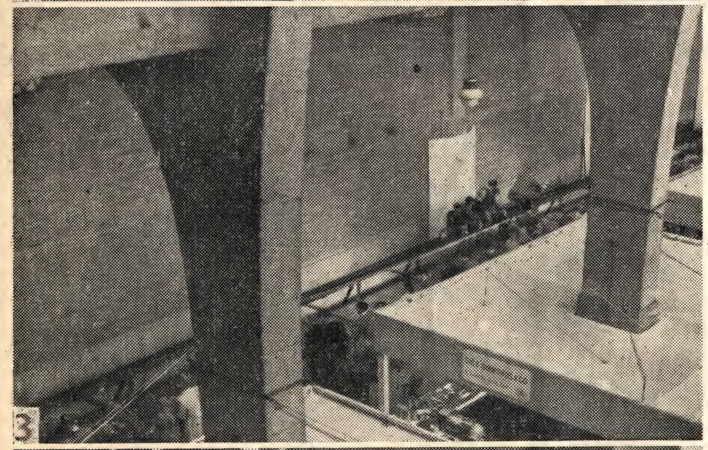
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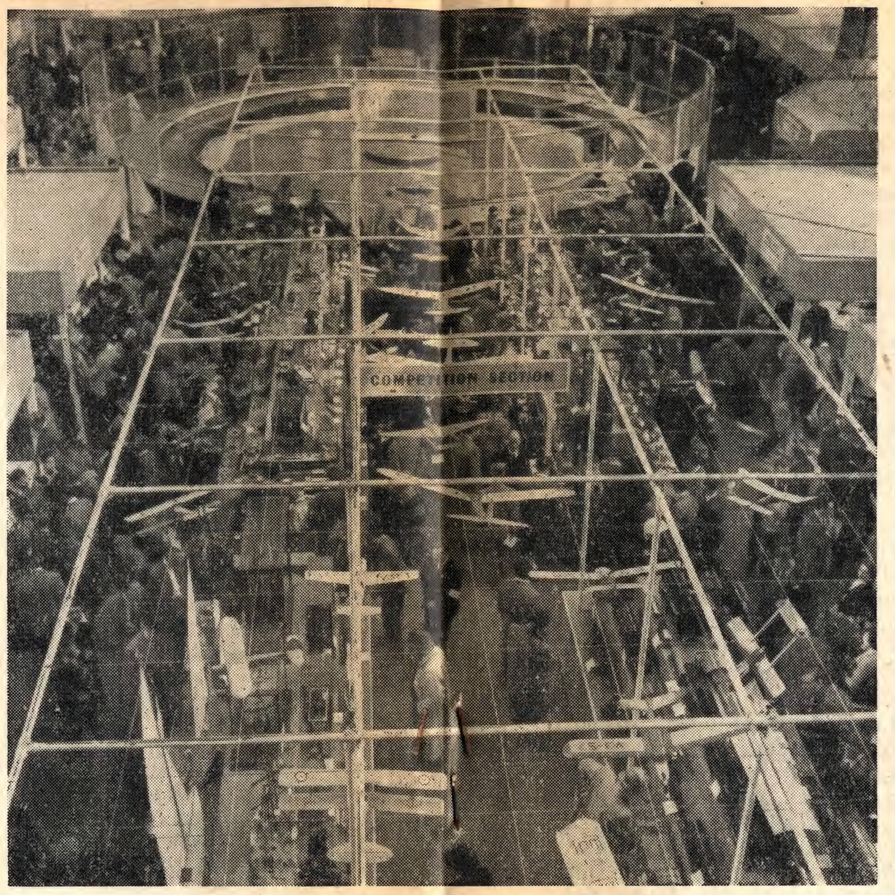

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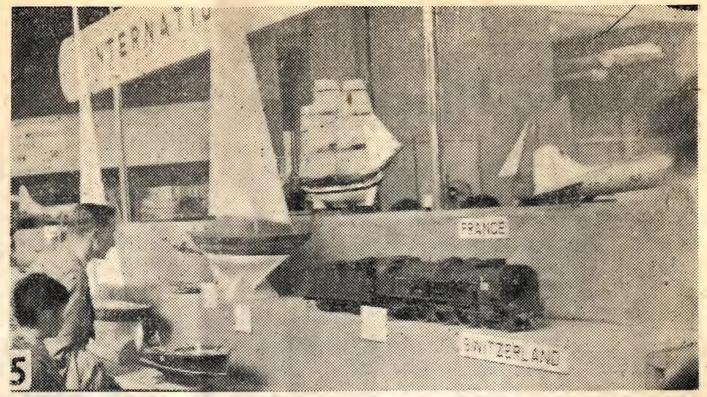


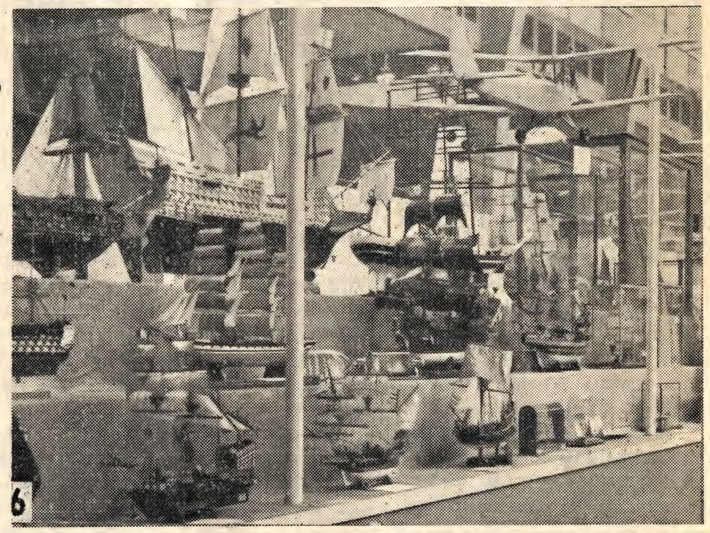


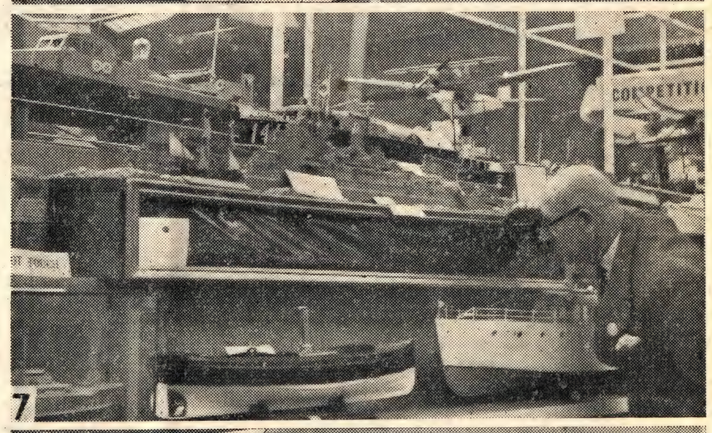


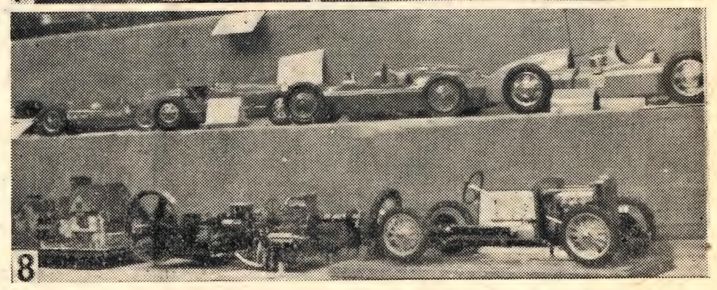












"Mechanics" visits the "Model Engineer" Exhibition

*Royal Horticultural Hall, London, S.W.*1, *August* 18*th*-28*th*

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*All exclusive "Mechanics" photos, H.P.*3. *MORE PHOTOS IN CLUB NEWS*

FINISH IT OFF — I

*By C. R. FOX**

Electro-Plating and Colouring at Home

MANY superb examples of model craftsmanship are spoiled by faulty or careless finishing; this can be seen at the various model exhibitions held all over the country. The finishing of a model, for some reason or other, does not seem to command the same amount of care, patience, or skill as all the foregoing machining operations; the model is usually improperly finished or even presented naked.

This short series of articles deals with general practical decorative finishes which can be done in the small workshop or home.

A vast subject has been condensed into three parts. First, simple and safe electro-deposition and virgin metal colouring. Second, preparation of metal for painting and decorating, also suitable materials to use. Third, equipment.

Electro-Deposition

Materials for this will be easily obtainable and safe to handle in the home. The principle of this system is that when acids, alkalis, or salts are dissolved in water they are broken up into minute particles called "ions." When an electric current is passed through an ionised solution the ions are carried and discharged at the electrodes opposite in polarity to their own charge; that is, negatively charged ions are discharged at a positively charged electrode and *vice versa*. In the case of the plating vat the current enters the solution via the anode and in passing to the article plated (which is connected to the negative lead), takes the metal out of the solution and deposits it on the article. In most cases almost an equal amount of metal is dissolved off the anodes and into the solution again.

Plating Baths

For home operation of a plating equipment the choice of metal depositions will be limited to those which for obvious reasons do not come within the Poisons Act. The choice has been somewhat narrowed to nickel and copper solutions, the uses of which will be found varied. Nickel plating has a number of advantages to offer the model engineer, for example, spun cylinder covers can most conveniently be made from any non-ferrous metal and in their virgin metal colour are not correct from the appearance point of view. As an alternative, a white deposited metal, suitably grained to represent spun steel, can be achieved very simply by the nickel-plating process. Also, nickel-plating presents a reasonably good rust inhibitor to steel and an excellent buffer coat if it is to be followed by a copper solution. No doubt, the individual ingenuity of the home plater will be able to find kindred objects to which

* *Member Harrow and Wembley S.M.E.*

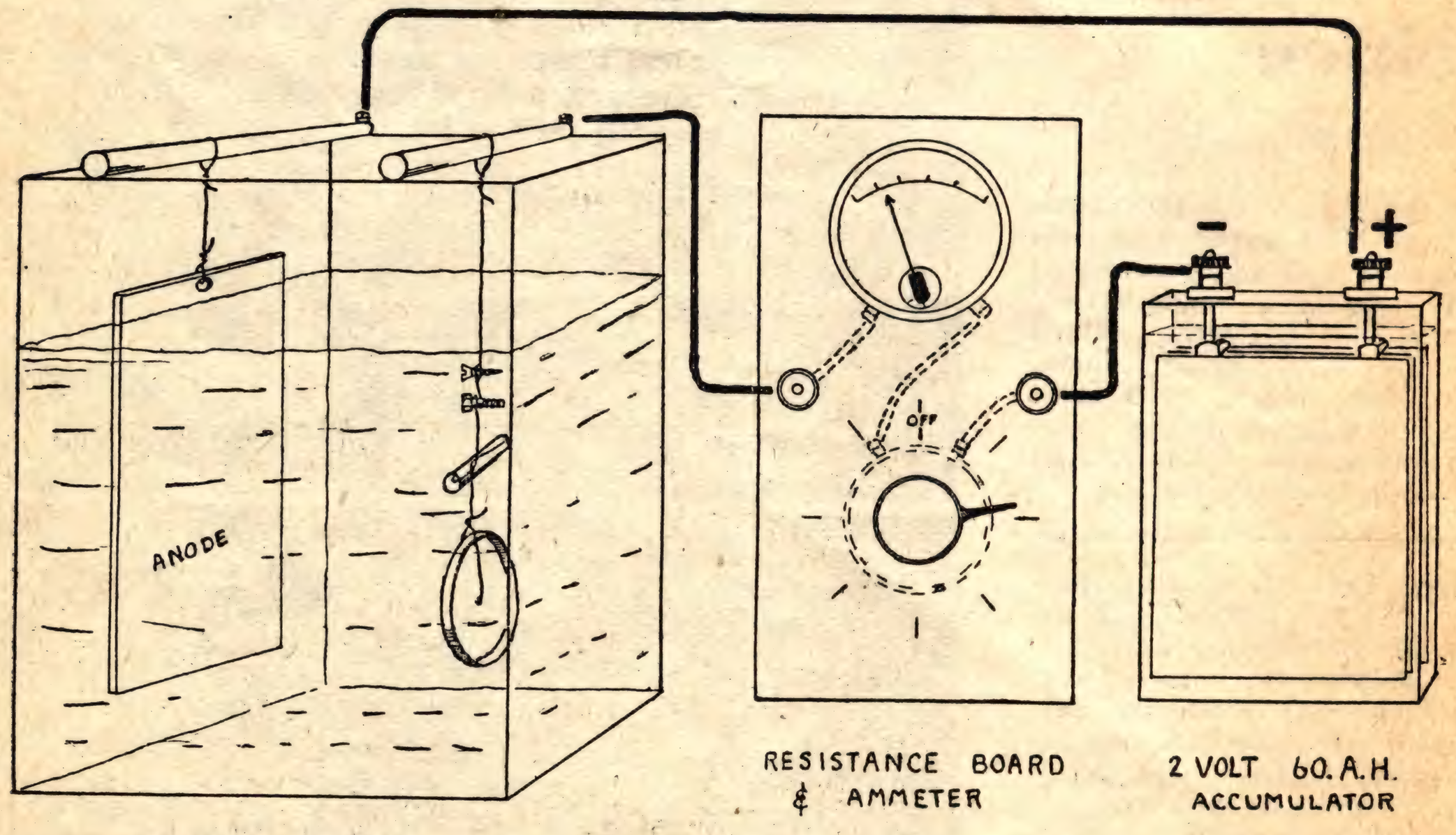


Fig. 1: Wiring diagram for the Plating Plant.

the application of a coat of nickel will be beneficial.

Equipment

The equipment required is very simple. The bath should be of reasonable dimensions according to the size of the work done. Glass tanks or containers holding approximately a gallon of water can usually be obtained from aquarists' suppliers. A rolled nickel anode of high purity should be obtained, the surface area of which should be roughly equal to or exceeding that of the object to be plated. A quantity of a nickel salt sufficient for the amount of solution to be made up; a source of current—a 2 volt accumulator of reasonable ampere/hour capacity being ideal; a small rheostat of approximately 10 ohms; if the operator wishes, an ammeter reading from zero to 5 amps. Most of these things can be found in the secondhand electrical equipment shops known to the majority of enthusiasts. The salt itself should be obtained from electro-platers' stockists and the type most suitable to requirements will be supplied on request.

Preparation

Care should be taken to keep the solutions perfectly clean, free from grease, impurities, etc., and they should not be allowed to come in contact with clothing or articles which may be used for culinary purposes, as they are slightly acid. The connections from the accumulator are: a wire running from the positive terminal and connected directly to the nickel anode, care being taken to see that the wire is not immersed in the solution. The negative lead is usually run in series with the resistance and ammeter (See Fig. 1.) and attached to a small rod upon which the work may be suspended in the bath.

Next comes the preparation of the article to be plated. Utmost care again must be taken to ensure that the article is free from grease, dirt, etc. The residual grease, oil, etc., can be removed by most solvents, such as trichlorethylene, etc., followed by a good swill in a suitable hot metal cleaning compound which can be purchased from electro-platers' stockists at a small cost. Thoroughly rinse and scour with a soft bristle brush to ensure that all nooks and crannies are cleaned and thoroughly wetted. After this operation see that the job is not handled by the fingers, as grease and perspiration will destroy the chemical cleanliness of the article, usually leading to a faulty deposit when placed in the bath.

Operation of Bath

The plating operation is simple. The work is suspended in solution by a piece of copper wire, taking care to see first that the current is switched to the beginning of the resistor. Failure to carry out this operation may lead to stripping later on. Having suspended the requisite number of articles in the bath the current may be increased proportionately. Excessive current may give rise to burning on sharp corners. This usually takes the form of apparent dulling or blackening of the deposit, which has a tendency to curl and peel off. A gentle and slow deposition will give a very much more secure and ductile film of metal. Articles may be left in the plating vat for any reasonable time according to the amount of deposition required. Upon removal from the bath a good swill in cold water, followed by a hot rinse and drying will usually be found to be sufficient. Buffing follows with the usual revolving calico mop and Compo or some other suitable graining process to represent a grained steel or any desired type of finish.

Black and Coloured Finishes

Black finishes present a slight difficulty, which can be overcome in rather a roundabout method, more especially if the articles to be treated are steel. A second bath will be necessary, incorporating the essential salts for copper, a copper anode and the same electrical equipment.

For plating non-ferrous articles, with the exception of aluminium and its alloys, etc., the article may be placed direct into the bath and plated in a manner similar to the foregoing remarks. Steel articles should be first given a good buffer coat of nickel, when they can be transferred, after a thorough rinsing, into the copper bath and proceeded with along similar lines. For various technical reasons it is not practical to plate steel direct in a copper sulphate bath as trouble usually arises later due to the interaction between the deposited metal and the steel itself—that is why an isolator is deposited first.

The advantage of the copper bath is manifold. It is a very simple metal to deposit and can be grown to incredible thicknesses, care being taken to see that nodular growths are not allowed to make themselves manifest. The article must be withdrawn from time to time and either buffed or carefully filed to remove these, degreased, and replaced in the bath for a further deposition. This trouble is overcome commercially by the use of the periodic current reversal system which need not be elaborated upon here.

To produce a black steel effect the procedure is as already mentioned (a buffer coat in the nickel bath if the article is ferrous), through the copper, and into a solution prepared from 4 fluid ounces of am-

PLATING PROCEDURE

METAL	1.	2.	3.	4.	5.	6.	7.
Non-Ferrous excluding Aluminium and its Alloys	Solvent Degrease	Well Scour in Hot Metal Cleaner	Cold Rinse	Nickel or Copper	Cold Swill	Hot Swill	Dry Out
Ferrous	Solvent Degrease. Pickle in Hydrochloric Acid if Rusty	Scour with Pumice Pdr. Wire Brush if Pitted	Cold Rinse	Nickel or Nickel followed by Copper	Cold Swill	Hot Swill	Dry Out
Copper Oxidise	Degrease	Grain, Scour or Scratch Brush	Cold Rinse	Ammon. Hydrosulph. followed by Fine Brass Scratch Brush	Cold Swill	Hot Swill	Dry Out

monium hydrosulphide to 1 gallon of water. Immediately the copper will begin to undergo various colour changes, through yellows to browns, to purples, and finally to black. At any stage through this range of colours the article can be removed and swilled in clean water, when the colour will be arrested. The article is then given a quick and brisk brush over with a fine brass wire brush or bristle brush, when the pure lustre of the oxidised metal will immediately become apparent; this finish should receive a coat of clear lacquer to preserve colour.

Using Copper as a Mask

With this simple equipment and by means of a little experimental work on these lines the plater will, no doubt, find many uses and effects which can be produced. The use of the copper again can be emphasised where case hardening is concerned. For example, on crankpins for locomotives where it is required to caseharden the actual bearing surface and leave soft the stub which has to be pressed into the wheel. This can be done by masking the surface to be casehardened with any good type of lacquer or protective, leaving the soft part exposed. This should be copper-plated and the lacquer removed from the part to be casehardened; the copper will effectively restrict the activities of the hardening compound and can be removed by turning off in the lathe after quenching. No doubt many other isolating problems may be solved by the same process.

Plating problems in this article have been deliberately kept to two simple solutions, as most other plating baths require the use of various dangerous cyanide solutions. Even if these could be procured in some manner they are dangerous and should be strictly avoided.

Next : Preparing metals for applied finishes

Readers' Questions Analysed

WE have just reached publication of the ten-thousandth query answered by our Technical Advice Bureau in the present series, which has been running for several years. Some facts about the service may be of interest to the many readers who make use of it.

Analysing a large and representative number of Readers' Questions Answered, the inquiries fall into the following percentages:

Electrical (including radio) ..	55%
General domestic construction ..	16%
Workshop	11½%
Castings and metallurgy	5%
Pumps, air and water problems	4¼%
Chemical	3¼%
Car troubles	2%
Miscellaneous	3%

Our panel of experts does not appear to have been defeated more than once in every 800 queries, though occasionally readers have written in for further information. Querists have not been charged fees except for special items, such as re-winds, for which we now ask a standard sum of 2s. 6d.: even when a fee is required, it has seldom averaged more than 1s. 6d. or 2s.

Less than 55% of questions answered are published, the remainder being discarded as unsuitable or of little general interest. We have answered "omnibus" queries (one querist sent us eight in one letter), but we do not encourage this practice.

From the foregoing it will be seen that this feature appears to be of real service to our readers and we hope to continue our help in this way. Appreciative comments are received from time to time and the letter that follows is typical of many:

DEAR SIR,—May I express my appreciation to *Mechanics* for the replies I have received under the "Technical Advice Bureau" during the last 12 months, which have enabled me to build

successfully a steel canal boat and also an efficient propeller, including all engine data.

Many thanks and continued success.

W. H. C.

Rugby.

Thus we come to our "celebration" query and for once we give the question (all three parts of it) and answers in full:

SWITCH TROUBLES

(10,000).—I have a two-way electric light switch in the bedroom and lately it will only go on at one position; it will not work properly both ways. I have examined the ceiling roses and both switches, but can find nothing wrong. Will you tell me the cause of this, please?

Again, the wiring here is all enclosed with flush 2-pin switching. I want to fix a water-heater (1½ galls.) in the scullery with a 3-pin switch for safety. How would you suggest fitting this? I have bought a tee-piece to fix to the cold water pipe, but my main difficulty is in fitting a 3-pin switch to 2-pin wiring.

Could you also give me some directions for alignment of the padding and trimming condensers of a wireless set? I have no signal generator. I have a pair of headphones and a voltmeter and milliameter.

The trouble is clearly a lack of contact on one side of the switch. Whether the switch or the cable is at fault must be found by trial.

The reason for the defective action can easily be seen by the aid of a simple diagram. Draw three dots in the form of a triangle, and underneath them, about 1½ ins. away, another three dots, but with the point down. Join the two pairs of outer dots. That leaves the two points free. Now draw one main connected to the top dot, and one side of the lamp to the bottom dot. The other side of the lamp will go to the second main. The joined dots represent the switch contacts, the single dots the switch blades. Draw these blades, and it will be seen that when both are inclined to the left, or both to the right, there is a complete circuit. If one of the side contacts is faulty, or if the connection is missing, only one side of the switch will be operative.

Test the switch contacts first and make sure that the screws holding the wire are tight. If they are in order the fault is in the cable. This will probably be a job for an electrician if the wire is run in conduit.

A 3-pin plug is wired exactly like the 2-pin type with the addition of a third wire to the large pin. This wire will be found fastened to the frame of the apparatus and can be traced by its colour. The large switch is joined to the metal casing of the house wiring.

In the absence of a signal generator the only thing that can be done is to set the tuning dial to the required station and then adjust the condensers until it is received. Afterwards adjust the trimming condensers for the best signal.

THE READER

Strangely enough, when we wrote to Querist No. 10,000, we were surprised to receive a reply from Mrs. E. A. Dacey, of Newport, Mon. Here are some details concerning her, given in a letter to us:

". . . So I am querist No. 10,000, and the 'queerist' part of all is that although *Mechanics* is mainly intended for men, I belong to the opposite sex, but that does not mean that I cannot mend an electric light fuse, fix a new earth to the wireless set, or stop the rattling in the loudspeaker when a wire is loose near the transformer. However, there are many jobs I cannot do, and that is where *Mechanics* comes to the rescue with expert advice.

"I am married and have two sons, one in the Services and one still at school. They are both, like myself, interested in music and wireless. Between us we have tackled numerous jobs and my husband helps as well when he has the time. We have a nice chest of tools of all kinds, and a couple of meters and headphones. Our greatest ambition for a long time has been to have a radiogram, but prices are much too high just now and we have to manage with an ordinary gramophone. I do some knitting, fruit bottling (and some growing) in the summer, a little gardening, and we also keep chickens . . ."

THE EXPERT

Appropriately, Mrs. Dacey's queries came within the field of a T.A.B. expert, who has been with *Mechanics* for longer than most. The initials "H.H.J." on a typed reply mean that Mr. H. H. Jones, of Birmingham, has brought his considerable knowledge and experience to bear on a reader's problem. H.H.J. comments on this occasion:

". . . By the aid of a slide rule and a few assumptions, such as an average of 250 words per reply and adding articles and other published matter, it appears that I have contributed something over three-quarters of a million words to your paper. This retrospect causes me to wonder what is the exact meaning of the people who say 'He seems to be getting on!' . . ."

This seems a suitable time to pay tribute to the patience and thoughtfulness of all our experts, who give every query full consideration and answer it to the best of their ability. Time, too, to thank those who write and express appreciation of help given. Our Technical Advice Bureau is one of the most popular features in *Mechanics*. We shall do our best to keep it so.

Southern 'Roedean' by 'L.B.S.C.'

A 'Schools' 4-4-0 in 3½ ins. gauge. 21st week



DRILL through with No. 44 drill, tap 6 B.A. and put in 6 B.A. screws, hexagon head for preference. Finally poke a ⅛ in. parallel reamer through both bushes at once; then you are absolutely sure they are dead in line, and there will be no binding of the link trunnions.

To erect the stay, proceed thus. At 2 7/16 ins. ahead of the centre of driving axle, and ¼ in. below top of frames, drill a No. 30 hole, with three more below it at ¼ in. centres and countersink them; see general arrangement drawing of the complete gear.

File off any burrs (very important when erecting), set the stay in position shown, level with frame top, and the front face 2¾ ins. ahead of driving axle; clamp temporarily in position, then make countersinks with No. 30 drill on the flanges, through holes in frame, follow up with No. 40, tap ⅛in. or 5 BA, and put countersunk screws in.

Expansion Link

The only difference between the expansion link itself, and its fellow-conspirators on the outside valve gears, is that it has no caudal appendage, the top and bottom ends being finished off to the same outline; so builders can go ahead and make the link and trunnion block to the instructions already given. Then cut out a piece of ⅛ in. steel plate to the outline shown in the illustration; the upper part is the same shape as the top of the trunnion block, and the "leg" similar to the curve of the link. The hole is drilled No. 32 and reamed ⅛ in. Attach this temporarily to the side of the trunnion block by a 1/16 in. screw. or a pin, before brazing the link to the trunnion block; then braze all the lot at one heating, to instructions already given.

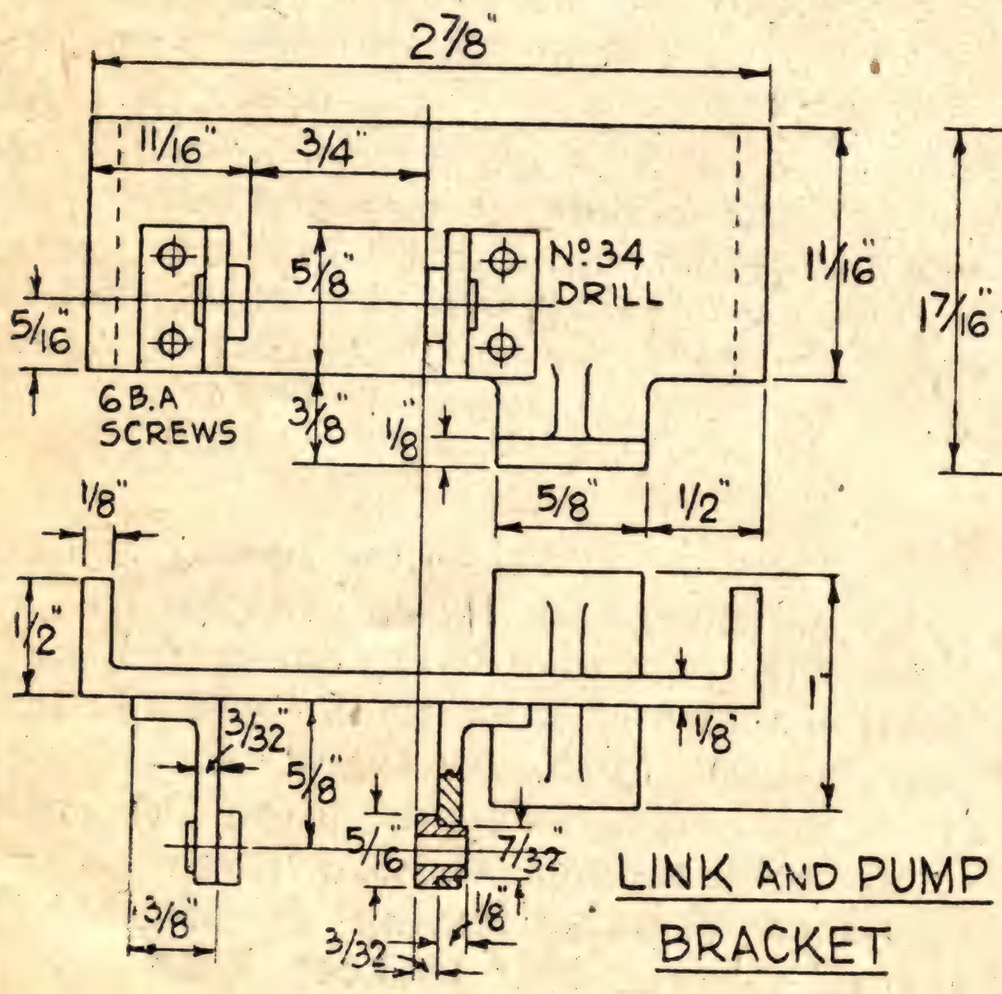
The only difference in the trunnion pins is that the one going through the side with the driving arm attached, is made ⅛ in. longer in the screwed part, as shown. Use the same strict caution as before to see that the trunnion pins line up exactly with the centre-line of the curved slot.

Eccentric Strap and Rod

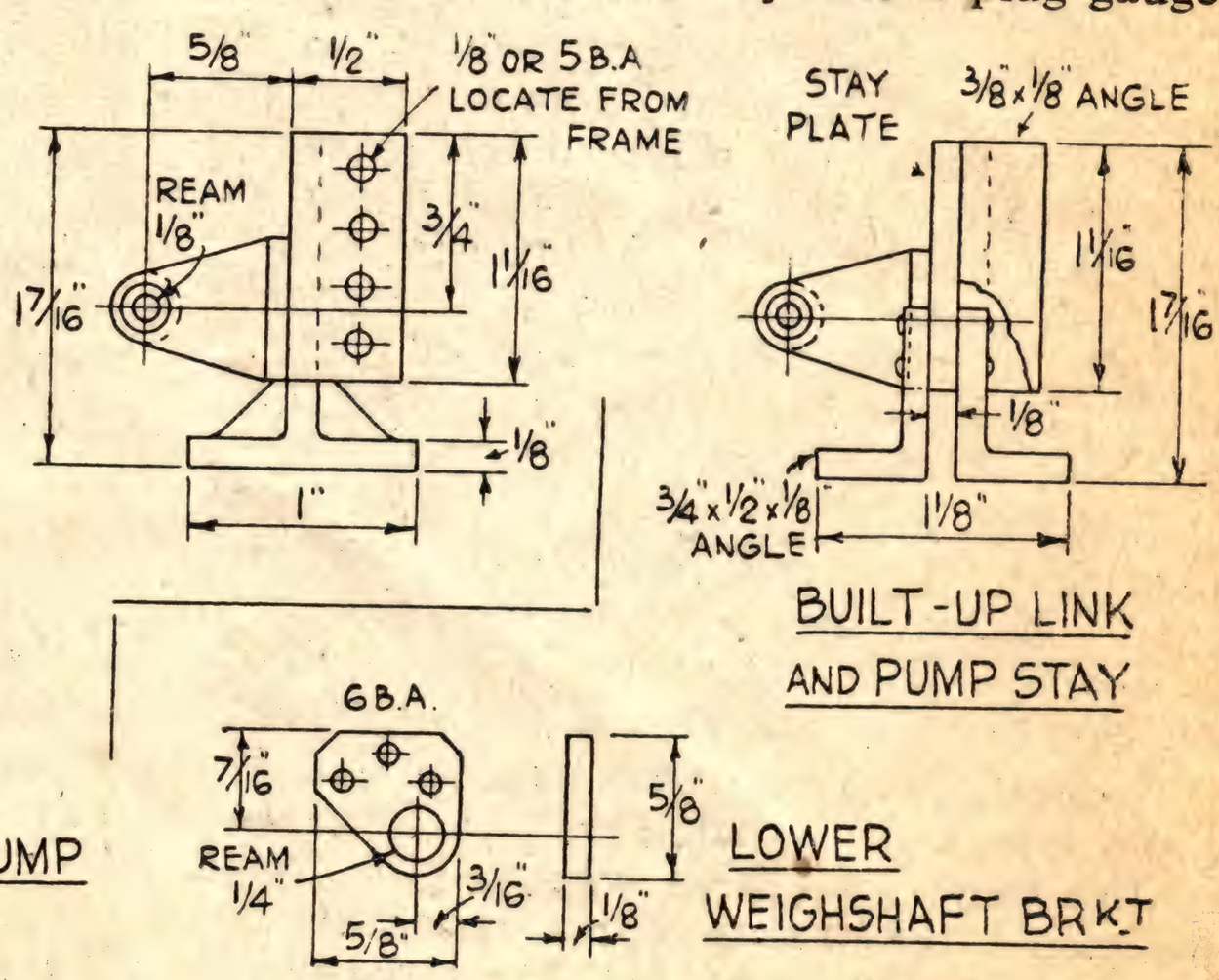
For beginners' benefit, the easiest way to machine eccentric straps is first to clean up the outside with a file, then centre-pop the ears or lugs, and drill right through with tapping size drill, in this case No. 40. Scribe a line across the middle of the lugs, catch in bench vice with this line just showing above tops of jaws, and saw across, keeping the sawblade pressed sideways against the tops of vice jaws. By this means you get a true parting.

Rub each half on a flat file laid on the bench, to take off the roughness left by the saw; then open out the holes in the ring part to No. 30, and tap those in the lug part ⅛ in. or 5 BA. The two halves can then be screwed together. Make a mark on both the lugs at one side, so that they can be replaced in correct relation whenever taken apart.

Chuck in four-jaw with the hole running as truly as possible; face off with a round-nose tool set crosswise in the rest, and then bore the hole to size with the same tool used to bore the cylinders. To get the correct diameter I always use a plug gauge;

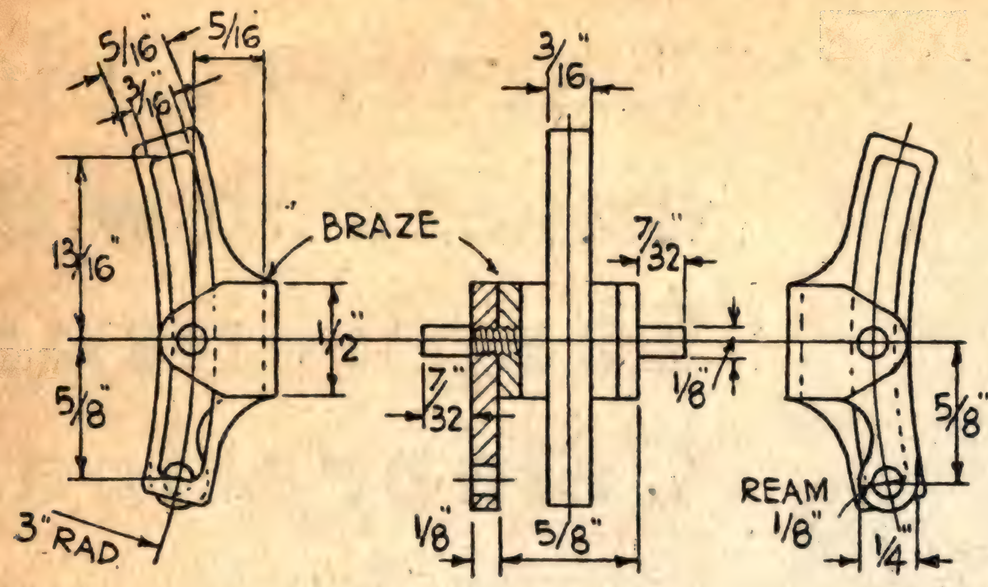


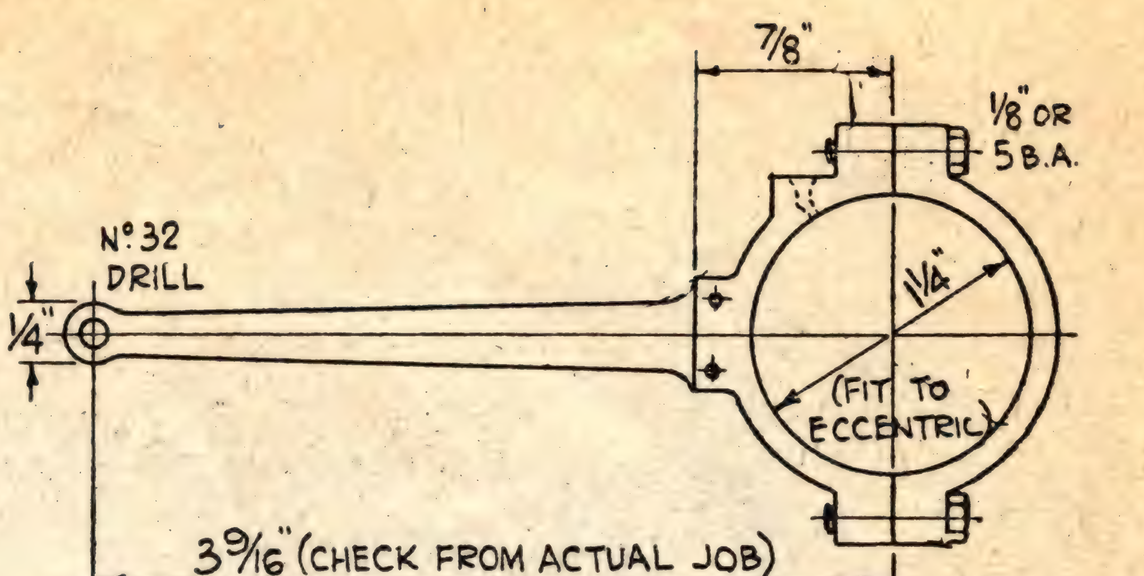
LINK AND PUMP BRACKET

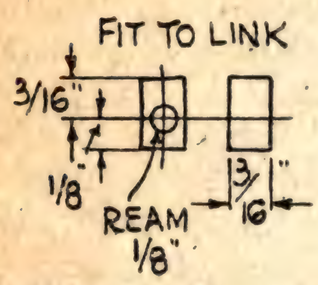


BUILT-UP LINK AND PUMP STAY

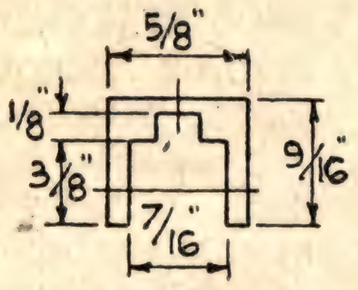
LOWER WEIGHSHAFT BRKT







DIE BLOCK



TRUNNION BLOCK

EXPANSION LINK FOR INSIDE VALVE GEAR

ECCENTRIC ROD

simply a bit of round rod the same diameter as the eccentric itself. It is only a few minutes' work to chuck the bit of rod and turn it to correct size, measuring with a "mike" or callipers. Bore until the gauge just slips in easily without shake. To face the other side of the strap, wrap a strip of paper around the gauge (one turn is enough) slack the screws in the strap, place on the end of the gauge, and tighten screws. It will now be held tightly enough to allow for facing off, with the gauge held in the three-jaw. If the strap wobbles sideways, slack the screws and tap it until it runs truly. Face off until the strap will fit easily, without shake, between the flanges of the eccentric.

The lug can be slotted with the same cutter used for the forked ends of the valve gear components, by holding the strap in a machine-vice on the lathe saddle, setting it at the correct height for the cutter to form the slot at one cut, and traversing it under the cutter by turning the cross-slide handle. *Note to beginners*: always feed *against* the teeth of the revolving cutter, never with them, otherwise if there is the least bit of slack in the slide screws, the teeth will catch in the work and drag the slide forward to the extent of its slackness, dig in, and damage the work, cutter, or both.

The eccentric rod can either be milled, or sawn and filed, from a piece of ½ in. x ¼ in. steel, or built up, using ½- in. x ⅛ in. strip for the rod itself, and brazing on a little block to form the forked end, which is machined up as described for the outside eccentric-rod forks, or the top of the combination lever. The tongue that fits into the lug in the eccentric strap should be a drive fit.

Assemble the lot to the dimensions given, but don't fix the rod into the strap permanently yet, as the length between centres may need slight adjustment owing to some slight inaccuracy in some other part of the gear. For instance, 1/64 in. error either way, in setting the link stay, would necessitate adjustment to suit, so that there would be no deleterious effect on the running of the engine. The old saw says "Two wrongs don't make a right," but the merchant who thought up that one, did not build locomotives, or he would have realised the truth of another old saw, which says "There are exceptions to every rule!"

Lifting Links

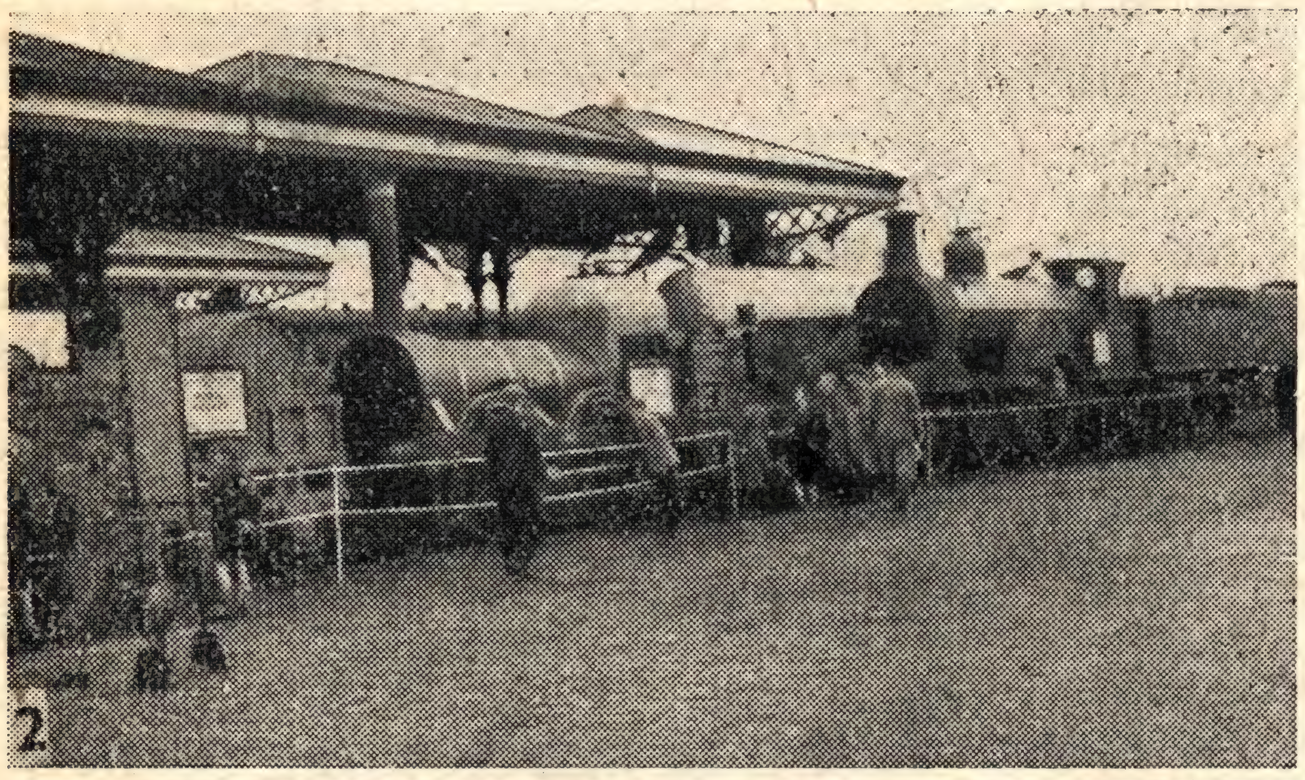
Three lifting links are needed, two for the outside valve gears, and a longer one for the inside gear. They are all made from ¼ in. square steel. No detailed instructions will be needed, as the operations have already been described for similar valve gear components. Just saw and file, or mill to shape and sizes given, same as for the combination levers and other parts. Thin-headed pins, turned from ¼ in. hexagon or 5/16 in. round steel, will be needed for the long link connecting the two weigh-bar shafts, another component which is made from ¼ in. square steel, same as the lifting links. The pins are just a plain turning job with the rod held in three-jaw, the sizes being given in the illustration.

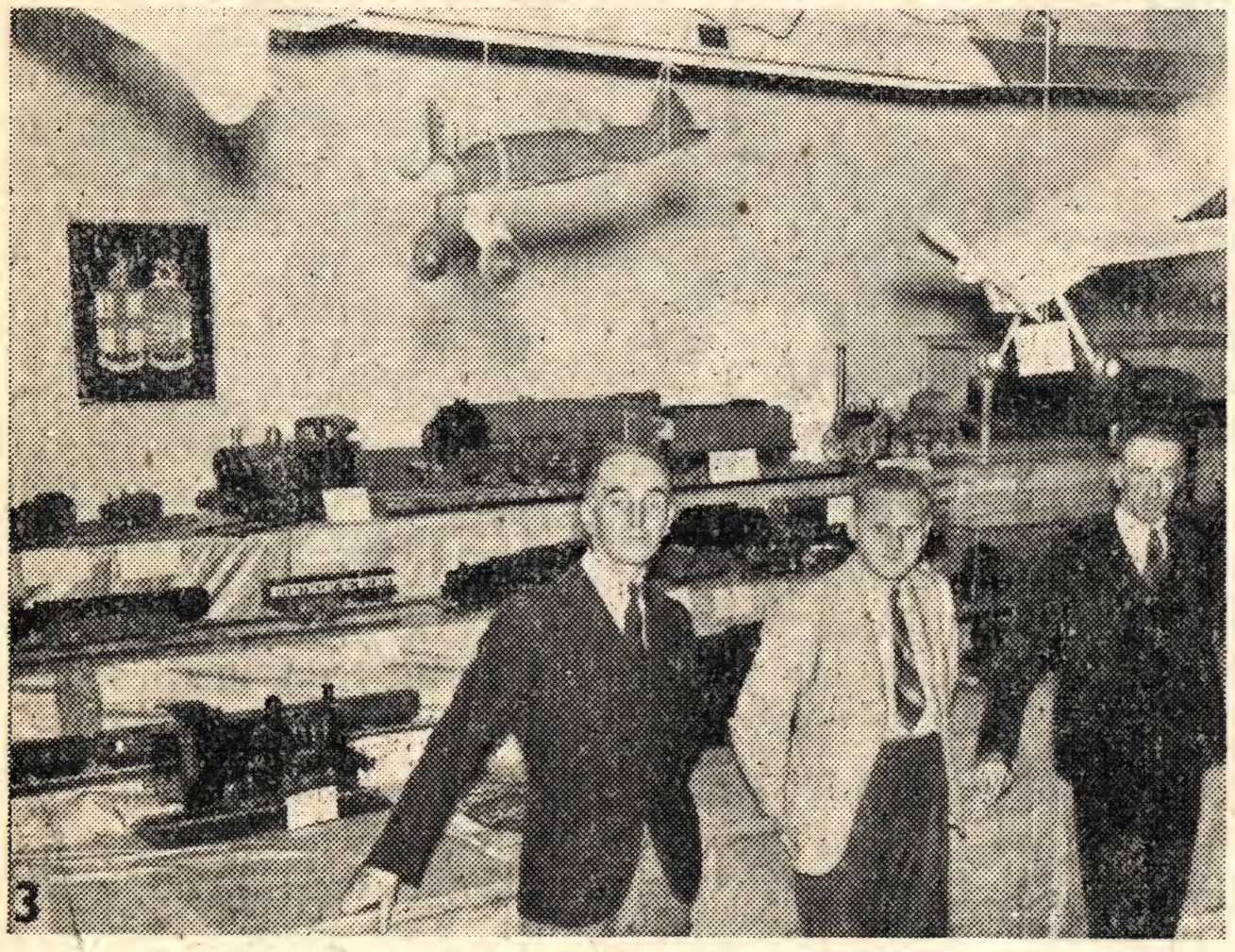
Inside Valve Gear Assembly

Put the solid end of the long lifting link between the jaws of the radius rod, opposite the inner holes, and drive a piece of ⅛ in. round silver-steel through the lot, filing off flush both sides. Put the eccentric-rod fork over the eye at the bottom of the driving arm of the expansion link, and pin that in similar fashion. To avoid any damage whilst squeezing in the pin, which can be done in the bench vice, put a piece of steel between the outside of the eccentric-rod fork and the link; then you can grip the lot, and squeeze the pin right home without fear of damage.

More next week







1. *Loco* 158*A* 2-4-0, *which, in its* 81 *years of working life, travelled* 1,660,000 *miles, with many of its original parts still being used, was a B.R. exhibit of a famous period in railway history. Withdrawn August,* 1947.

2. *M.R. No.* 118, *built* 1897 *at Derby, ran* 774,000 *miles, withdrawn from service in* 1928. *It is an example of the famous Midland "Spinners."*

3. *Chesterfield and District M.E.C.* (L.), *Hon. Sec. B. Chambers. Next, Chairman L. Burkinshaw.* (R.), *A. H. Kay, Chairman Loco Section.*

*"Mechanics" photos H.P.*3.

Chesterfield makes a hit with Stephenson Celebrations

CHESTERFIELD and District M.E.C. made a hit with the George Stephenson celebrations when, with the help of neighbouring clubs and loaned exhibits, they took part in the Exhibition at Chesterfield. As mentioned in *Mechanics* leading article last week, the small locomotives gave visitors a pretty good clue as to how history can be preserved through the enthusiasm of model and experimental engineers. Two portable loco tracks on which ran Austen-Walton's Centaur and Sheffield S.M.E. member's loco attracted the crowds.

My pictures on the left show the style taken by British Railways with their exhibits, and loco 158A has a record of which the builders could well be proud.

Chesterfield Club meet every Tuesday at Bradbury Hall, and I should think its present membership of 106 will be increased by the interesting displays which included photographs of Theo Pearson's railway and of aircraft that aroused enthusiasm.

Hon. Sec., B. Chambers, 78 *Heaton Street, Brampton, Chesterfield.*

Noise Stops Regatta

I HEAR that the Lowestoft and Alton Broads Regatta, scheduled as an International affair, has been cancelled through noise causing residents to object. This is another piece of evidence showing that the public are becoming somewhat antagonistic to the noise caused by i.c. engines whether in model race cars or in big power boats.

Glasgow Track

In August 6th Club News I published two pictures of enterprising Hon. Sec. J. W. Smith of Glasgow & District S.M.E. examining the 110 ft. straight of that Society's track at Rutherglen. When I was up there July 22nd Mr. Smith and I had a good look round the track, whose kidney shape I have referred to previously. Set in some waste ground adjoining an old factory, the

track has entrance from the main road. Brick pillars have been erected to accommodate the pre-cast supports: bolted on to these supports are well seasoned wooden battens on which is placed the track. The whole site has been well surveyed, and when finished next year Glasgow & District S.M.E. should have a track with which they can be well pleased. Loco enthusiasts will have some interesting driving, and it is planned to instal electric signalling equipment.

Hon. Sec., J. W. Smith, 785 Dumbarton Road, Glasgow, W.1.

Hayes Track in Operation

Writing of tracks reminds me that August 15th was a Gala Day for Hayes and Harlington M.E.S. I saw about 100 ft. of this with rails installed, but the site of the track is going to be a very pleasant one since it is in an orchard in the grounds of Mr. C. E. Shackle, their President. Total length will be 424 ft. with a straight of 100 ft., radius of curves at either end 35 ft. and a bend on the other side of the track. Design of the arches is shown in my pictures on the right. Much hard work has gone into the building of this track.

My last picture shows the balance lifting bridge being operated by Mr. Shackle: it follows lines adopted by the G.W.R.

Harrow and Wembley S.M.E. collaborated with Hayes in their Gala Day, which enabled enthusiasts to try out their locos.

Hayes Exhibition will be September 11th at Townfield School, Central Avenue, Hayes, Middx.

Hon. Sec., G. T. Maughan, 81 Kingshill Avenue, Hayes, Middx.

What the Clubs are Doing

Bits and Pieces at Harrow

August 11th meeting of Harrow and Wembley S.M.E. was a "Bits and Pieces" which enabled members to discuss with their fellows some of the problems which arise in their activities.

August 29th will be a Gala Day at Kenton Grange.

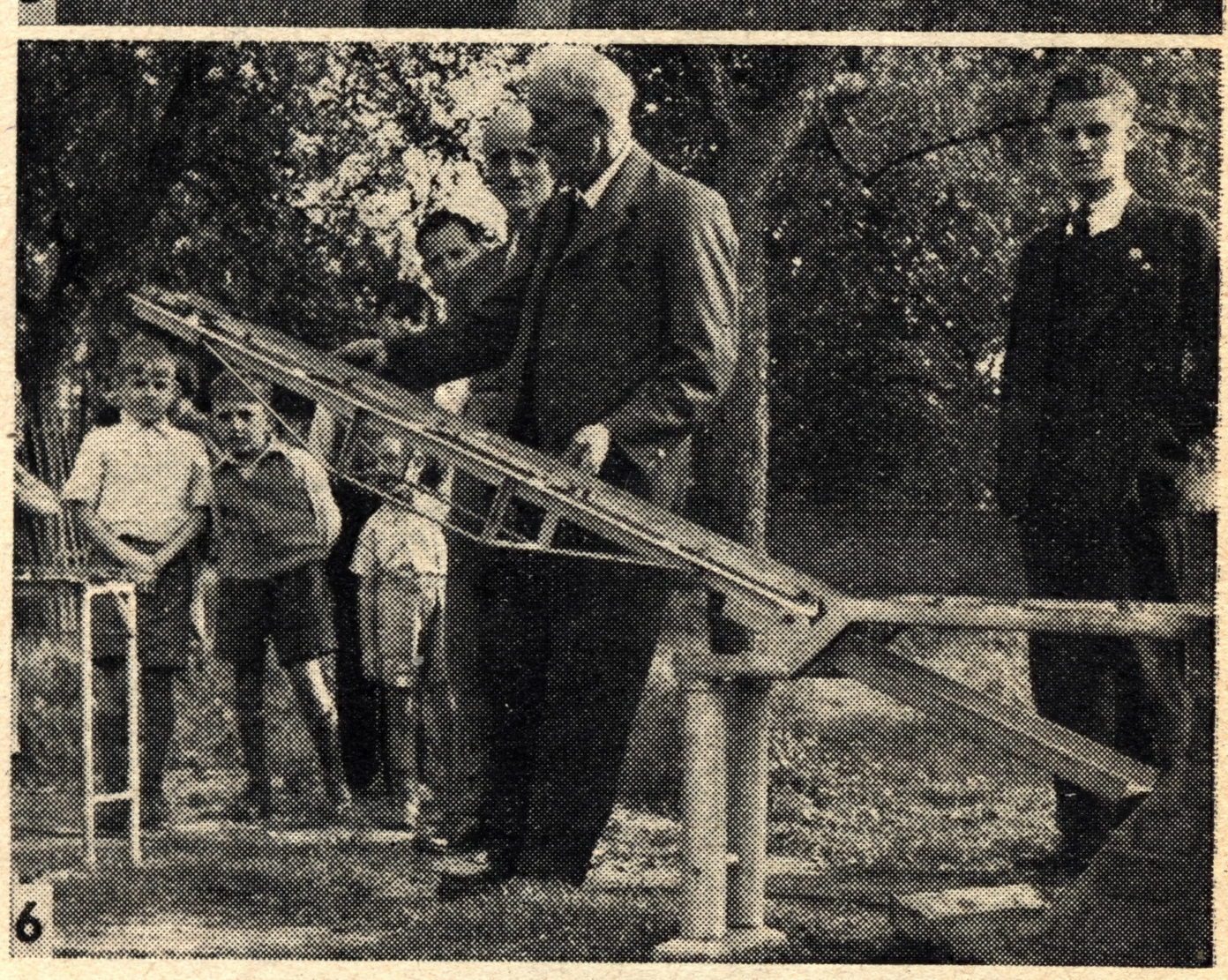
Hon. Sec., A. D. Pole, 13 Churchfield Close, Woodberry Avenue, N. Harrow, Middx.



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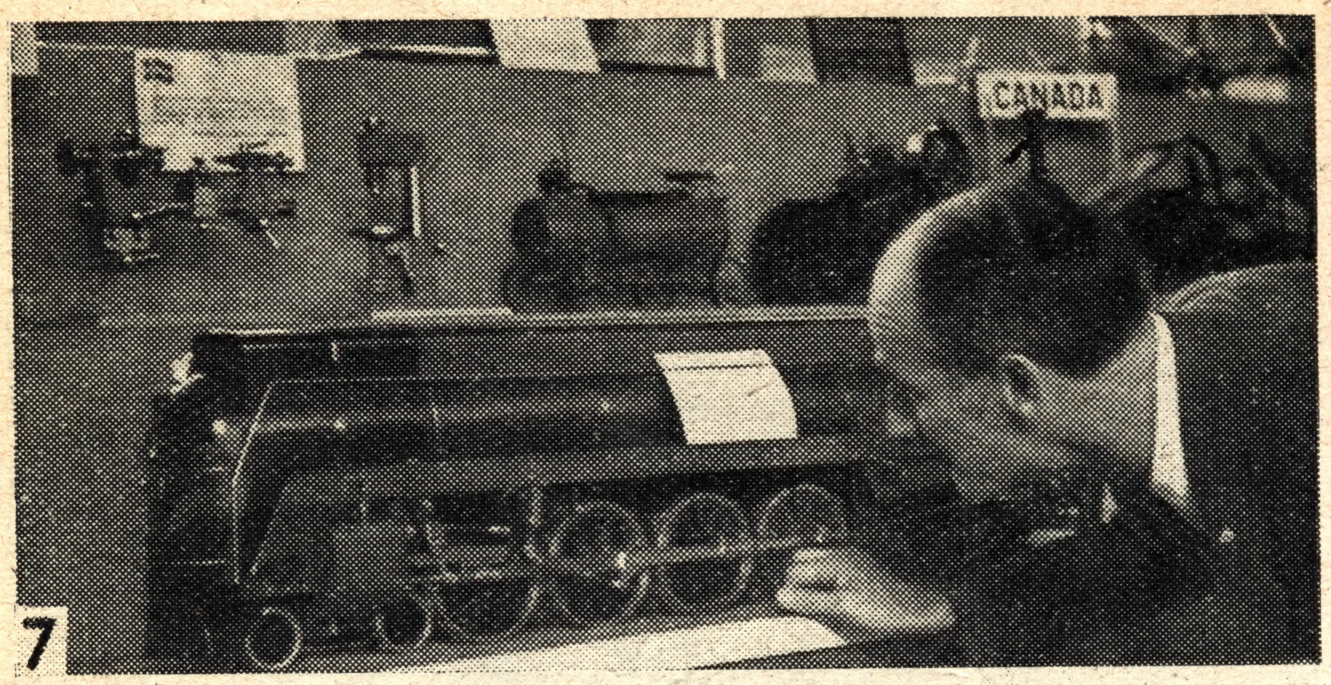
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4. *Hayes and Harlington track is delightfully set in an orchard, and members tell of the great interest shown in its construction by the resident goats and horses.*

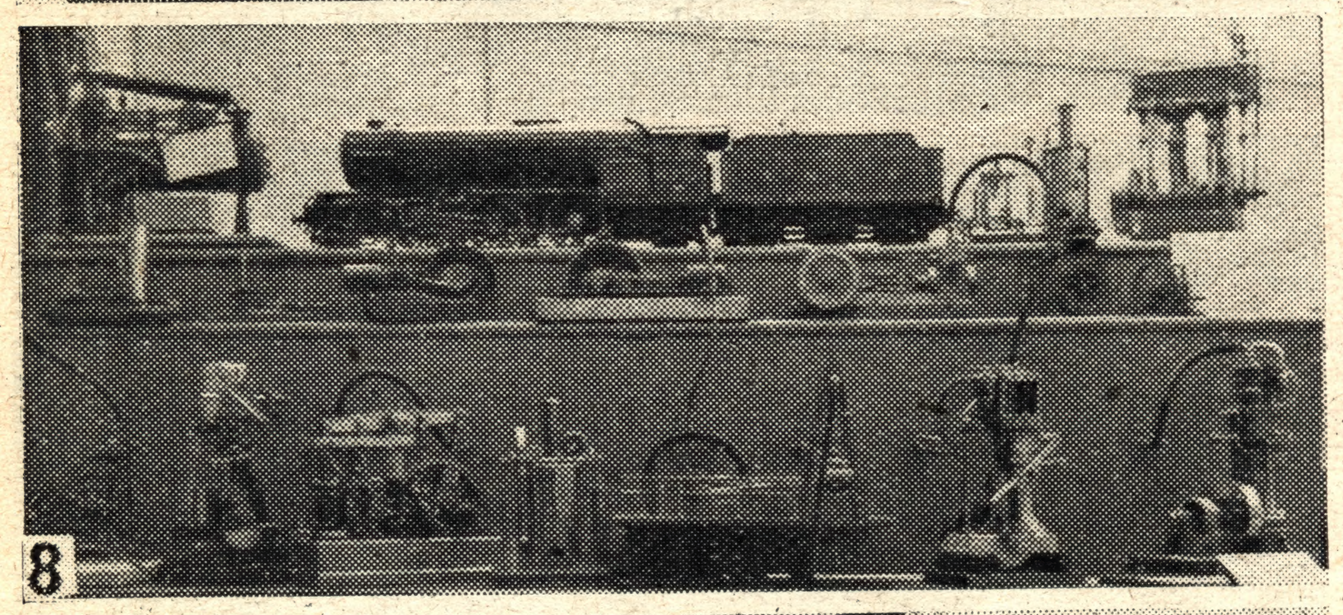
5. *The footings of Hayes track are well shown in this photograph.*

6. *President C. E. Shackle lifts the balance lifting bridge while young spectators watch the photographer.*

"Mechanics" photos H.P.3.



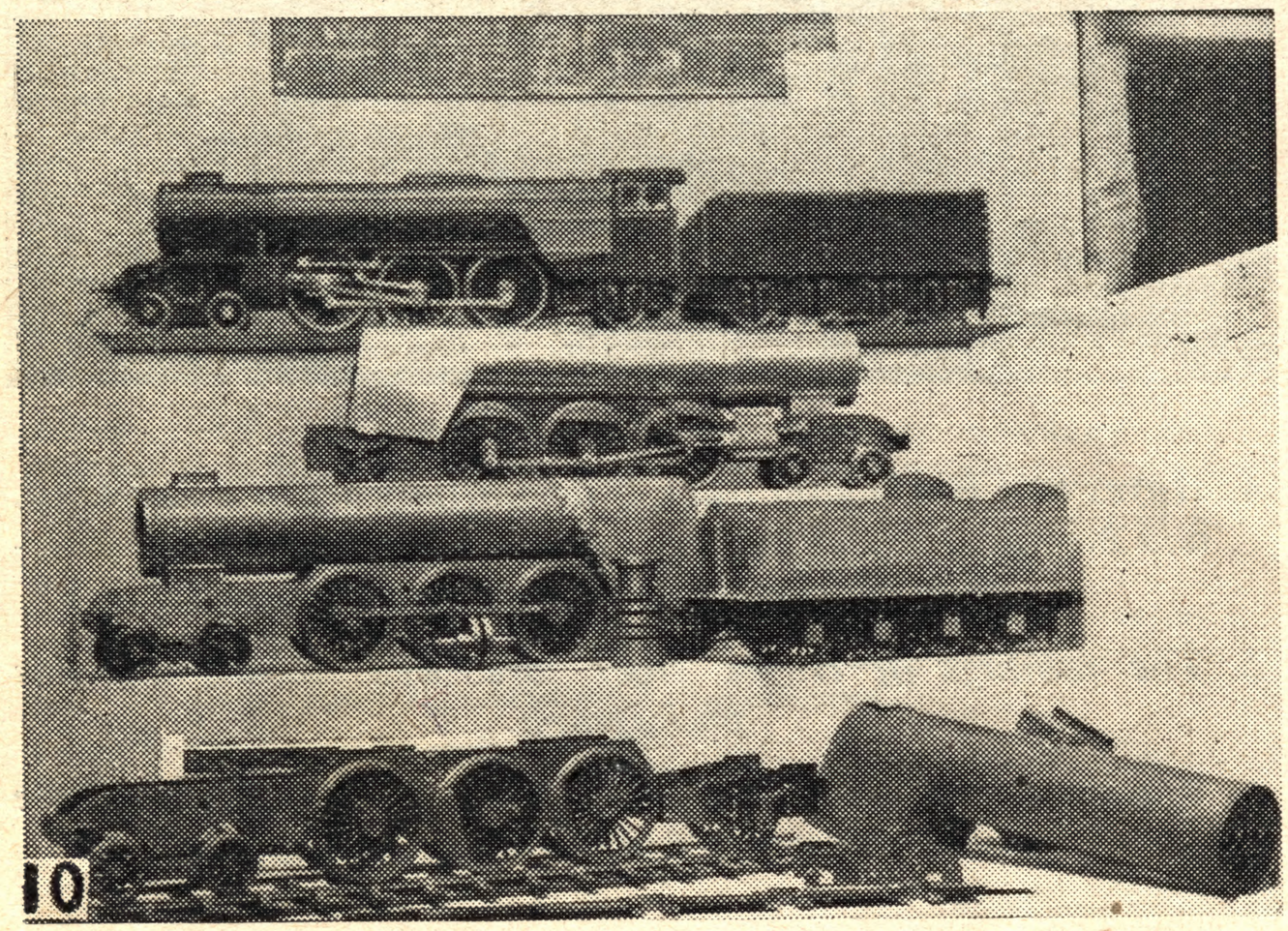
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"M.E." Exhibition

AS I walked round the "M.E." Exhibition—its 23rd—I could not resist the feeling that it was an inspiring tribute to the enthusiasm of amateurs all over the country, and in the loco section a testimony to the leadership given by "L.B.S.C." in small loco construction. Looking at the magnificent locos I thought of the tremendous expansion of the movement in the past twenty-five years and it is very significant that it is just that length of time that "L.B.S.C." has been writing for *Mechanics*. I know that I speak the thoughts of thousands of club members in saying that this Exhibition and, indeed, all the hundreds of exhibitions that occur throughout the country showing small-scale locomotives are ever-present reminders of the unique ability of "L.B.S.C." to enthuse and to instruct the small locomotive builder, even though he may be but a tyro.

I have put the four photographs of the M.E. Exhibition on the left as they indicate club activities.

Some Results

CHAMPIONSHIP CUPS

LOCOS: 7¼ ins. gauge 1½ ins. scale 4-6-2 L.M.S. "Duchess of Buccleuch," by H. C. Powell, of Crewe (see centre pages).

STEAM AND MOTOR SHIPS: River pilot boat, 2-cyl. i.c. engine, by T. Fletcher, of Colne, Lancs.

SAILING SHIPS: Norwegian jagt "Gjoa," by W. H. Honey, of Tulse Hill.

MODEL AIRCRAFT: Semi-scale power driven i.c. engine C.1, by S. A. Miller, of Luton.

CLUB CHAMPIONSHIP AWARD: (a) *Locos*. Ilford and W. Essex Model Railway Club. (b) *Aircraft*. Luton and District Model Aeronautical Society.

BRISTOL CHALLENGE CUP: Bristol type 123 by G. H. Hobbs, of Chippenham, Wilts.

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7. *A. Ohlen from Sweden examines a 3½ in. gauge C.N.R. steam loco 4-8-4 which drew the Royal train in 1938. Made by R. D. Wood, Toronto 3.*
8. *Working models on S.M. & E.E. stand attracted interest.*
9. *Brighton and District S.M.E.E. stand, with member G. H. Davis.*
10. *Malden and District novel display. Hielan' Lassie from blueprint to finished job in four stages.*

"Mechanics" photos H.P.3.

CLASSIFIED ADVERTISEMENTS.

Rates: 3d. a word (private); 6d. a word (trade); Box No. 1/- extra. Cash with order. Classified Advertisement Department, "Mechanics," 2 Breams Buildings, London, E.C.4. Holborn 5708.

CLEAN copies "Model Engineer" 1945-8 30s.—Box 142, "Mechanics."

ELECTRIC Motors. Our famous range of motors again available FROM STOCK. Example: ¼ h.p. single-phase 200/250 v., 1,400 r.p.m. From £6 16s. 6d. Send for lists.—John M. E. Steel, Dept. 6, Bingley, Yorks. Phone: 1066 (4 lines).

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MOTORISED 13-speed ½ in. capacity Bench Drilling Machines. Price £18 10s. Also 4 ins. and 6 ins. Wood Planing Machines, Belt Sanders, Air Compressors, Pumps, etc. Stock Delivery.—John M. E. Steel, Dept. 6, Bingley, Yorks. Phone: 1066 (4 lines).

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"RUNBAKEN" High Speed Multi purpose tool de-luxe. Universal Motor on A.C. or D.C. complete with three steel cutters and three grinding stones. Little used. Cost £25. Nearest offer £20 secures.—S. Lavercombe, Holmehurst Cottage, Lower Warberry Road, Torquay.

SALE workshop machinery books s.a.e. list.—51 Islip Manor Road, Northolt, Middx.

SINE Bar 5 ins. Precision Ground as new £2. 0 in.-1 in. Micrometer perfect order B. & S. 30s. 0 in.-3 ins. Depth micrometer B. & S. 4 ins. base £2. 1½ ins.-12 ins. Inside Micrometer in case Lufkin New £3. All genuine Bargains.—122 Kenley Road, London, S.W.19. Liberty 3768.

SALE, Lathe, 3½ in. Myford; stand, countershaft, chuck; £30. Make appointment.—14, Torrington Park, Finchley, N.12.

STEAM-CAR engine Twin D.A. P.V. simple 10 to 12 h.p. Largely machined, drawings, races, materials. Cost £80. What offers? Also coke boiler casing 23 ins. diameter hoppers, etc., weight 120 lbs.—Doyle, 77 Hythefield Avenue, Staines, Middx.

TRANSFERS for decorating Toys, Trays, Firescreens Lampshades. Trademarking. Selections 10s. floral, pixies, galleons, etc.—"M" Axon Harrison, Jersey.

THE Handyman's "Odds & Ends" Mixture, approx. 3 lbs. assorted screws, nuts, washers and various components, all high grade surplus from production runs, in glass jar, post free 7s. 6d. "Bits & Pieces" 3 lbs bundle of free-cutting brass and steel rods, various diameters, length 6-8 ins. post free 6s. 9d. Precision B.A. Screws, etc. Stamp for lists.—Spencer Components, 22 Caroline Street, Birmingham, 3.

UNUSED Engineer built 30 c.c. Atom V complete on test bench with coil tanks, etc., £10.—Box 141, "Mechanics."

WATCHMAKERS and Experimenters. 6 Geneva watch movements, 15s. the 6. Six Beautiful English Lever Movements, 35s. the 6. Six Giant 3/4 Plate English Lever Chronometer Balances Centre Second Chronographs from 18ct. Gold Cases. Take £3 the 6. Six Georgian Verge Movements, 20s. the 6.—Merkels the Old Firm, Pilgrim Street, Newcastle.

WATCHMAKERS demobbed need Lathes to start work again. John Morris (Clerkenwell) Ltd., will pay high prices for lathes by Lorch, Boley, Wolf Jahn and American and Swiss makes. — 64 Clerkenwell Road, E.C.1. CLE 6077.

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4 INS. Belt Sanders-ball bearing throughout, adjustable fence and backstop, £7 10s.—F. Simpson, Woodcutting Machinery Maker, Seacroft Green, Seacroft, Leeds.

2½ INS. gauge "Green Arrow." Drawings, Castings. Boiler Material. Finished parts include frames, hornblocks, axles, main crank, eccentrics, 3 wheels. Unable to continue, £9 lot.—Box 139, "Mechanics."

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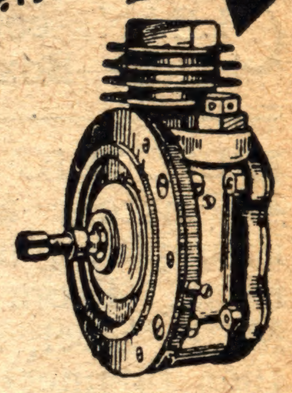
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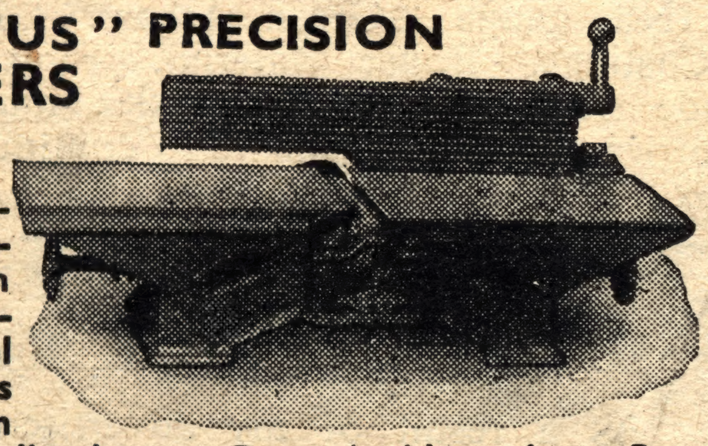
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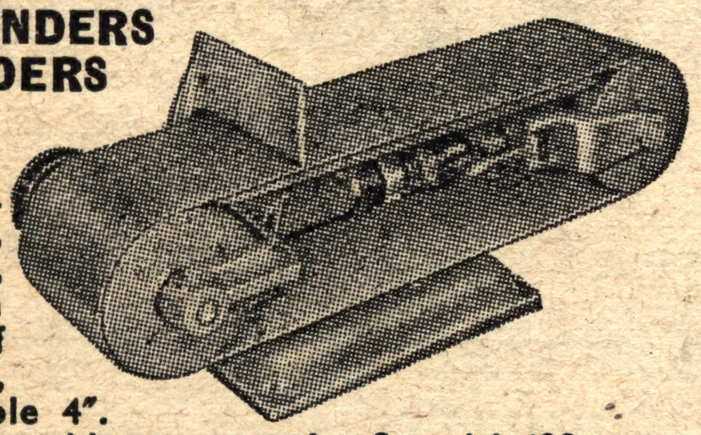
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